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2003-2004/40

Space Cadre/Space Professionals

SPACE CADRE/SPACE PROFESSIONALS

HEARING

BEFORE THE

STRATEGIC FORCES SUBCOMMITTEE

OF THE

COMMITTEE ON ARMED SERVICES
HOUSE OF REPRESENTATIVES

ONE HUNDRED EIGHTH CONGRESS

SECOND SESSION

HEARING HELD

JULY 22, 2004



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SPACE CADRE/SPACE PROFESSIONALS

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SPACE CADRE/SPACE PROFESSIONALS

HOUSE OF REPRESENTATIVES,
COMMITTEE ON ARMED SERVICES,
STRATEGIC FORCES SUBCOMMITTEE,
Washington, DC, Thursday, July 22, 2004.

The subcommittee met, pursuant to call, at 2:02 p.m., in room 2118, Rayburn House Office Building, Hon. Terry Everett (chairman of the subcommittee) presiding.

OPENING STATEMENT OF HON. TERRY EVERETT, A REPRESENTATIVE FROM ALABAMA, CHAIRMAN, STRATEGIC FORCES SUBCOMMITTEE

Mr. EVERETT. The hearing will come to order.

The subcommittee meets today to receive testimony on the development of a space cadre—a group of space professionals from all areas: military, industry and academia.

I want to welcome all the witnesses who have agreed to share their expertise with us today on this important subject to the subcommittee.

For our first panel today, I want to welcome Under Secretary Teets, who is testifying today as the head of National Security Space Programs.

I also want to welcome the service-based program heads: representing the Air Force, General Lance Lord, Commander, Air Force Space Command; for the Army, Lieutenant General Larry Dodgen, Commander of Space and Missile Defense Command; for the Navy, Rear Admiral James McArthur, Commander, of the Navy Network Warfare Command; and Brigadier General John Thomas, Director of Command, Control, Communications and Computers and Chief Information Officer for the Marine Corps.

Following the remarks of the first panel, I would invite committee members to ask questions.

For our second panel today, I want to welcome representatives from the space industry as well as academia.

Testifying will be Dr. Robert Calico, Provost of the Engineering and Management Department, Air Force Institute of Technology; Captain Dan Bursch, United States Navy, Associate Dean of Graduate School of Engineering and Applied Sciences, Naval Postgraduate School; Mr. John Douglass, President and CEO, Aerospace Industries Association; Dr. Pam Shockley-Zalabak, Chancellor, University of Colorado-Colorado Springs; and Dr. Victoria Coverstone, professor of aerospace, University of Illinois at Urbana-Champaign.

We have a great deal of ground to cover today and we are likely to get several interruptions during that period. And I want to give

the members as much leeway as possible in asking questions. And we will not get to all the questions we would like answered today and we would ask for you to respond to some written questions, and please do it within 30 days of receiving those questions.

Likewise, Secretary Teets, I would ask you to be brief with your prepared remarks. The entirety of your written statement will be entered into the record.

The entirety of the statements from our service representatives will also be entered into the record. And I have read all of them, and I must commend you for those remarks that you have made and all this progress that we will talk about.

The development of a space cadre was a major thrust in the findings of the Space Commission 2001 report. The report emphasized the need to create and maintain a highly trained and experienced cadre of space professionals who could master highly complex technology, as well as develop new tactics and doctrines for space operations in the future. Slowly, the development of a space cadre has evolved. In an effort to encourage the process, the National Defense Authorization Act for Fiscal Year 2004 directed the department to develop a strategic plan to coordinate and facilitate the development of space personnel career fields and integrate them into larger personnel systems for each service.

It also directed each service to develop and take a more proactive stance in the development of its space cadre.

The committee is concerned about the breadth and depth of the current Department of Defense plan. It seems to lack sufficient detail and structure for implementation.

Additionally, in the area of education and training, as well as in addressing the role of academia and industry in the space cadre, the committee has concerns. The committee believes that the accumulation of skills and the capabilities of government, academia and industry represent a comprehensive view of the military space community for the United States. Each has valuable tools and expertise to contribute. We all look forward to hearing the witnesses' suggestions on how this talent and culture can be cultivated and incorporated into the development of a space cadre in the military and for space professionals at large.

Today, I look forward to exploring the status of each of your efforts and sharing ideas on potential solutions to developing today's space cadre and tomorrow's space professionals.

At this time I would like to recognize my friend and distinguished ranking member, Mr. Reyes, for any comments that he may have.

[The prepared statement of Mr. Everett can be found in the Appendix on page 39.]

STATEMENT OF HON. SILVESTRE REYES, A REPRESENTATIVE FROM TEXAS, RANKING MEMBER, STRATEGIC FORCES SUB-COMMITTEE

Mr. REYES. I thank you, Mr. Chairman, and thank you again for holding this very important hearing.

I want to join you in welcoming our distinguished guests and we look forward to their testimony.

Mr. Chairman, when the Space Commission assessed national security space management and organization in January of 2001, they wisely recognized that organizational charts and management theories are not worth much if you do not have quality people.

And frankly, they recognized that the Department of Defense was not focused in any coherent way on developing personnel who would be knowledgeable about the national security issues and its implications in space.

So one of their main recommendations was to create a space cadre. The American Heritage Dictionary defines cadre as follows: a nucleus of trained personnel around which a larger organization can be built and trained.

The Space Commission used the word "cadre" deliberately. It recognized that none of the services was training a critical nucleus of expertise in space matters and that the national security was sure to suffer without such expertise.

Acting on the Space Commission recommendation, Secretary of Defense Rumsfeld, in October of 2001, issued a memorandum directing the military services to draft specific guidelines and plans for developing, maintaining and managing a cadre of space-qualified professionals.

While the Air Force is directed to coordinate efforts among the services, each service is responsible for establishing its own cadre of space personnel, space experts.

We have asked our witnesses from the department to tell us how we are progressing. And from things that we have heard, in all honesty, many of us are going to be disappointed in what we hear today.

One question that I would like our department witnesses to address is the following: If space is critical to our national security, do we need joint management? Or is this something that we should let the services do on their own, which so far has resulted in uneven progress across the departments, or should we look at establishing a joint operation to achieve these goals?

As is obvious, Mr. Chairman, none of us knows the answer to that question. But certainly today I would like to hear our witnesses from the department address it.

Mr. Chairman, I also appreciate the fact that you have asked experts from industry and academia to join us on a second panel. We need to develop a nucleus of trained space experts, not just in our military, but in our aerospace industry and academia as well.

I think that the subcommittee is correctly viewing the issue of space cadre broadly, and I look forward to the testimony of both panels.

With that, Mr. Chairman, I will yield back my time.

Mr. EVERETT. I thank my distinguished colleague.

Mr. Secretary, I look forward now to your testimony.

STATEMENT OF HON. PETER B. TEETS, UNDER SECRETARY OF AIR FORCE, SPACE

Secretary TEETS. Mr. Chairman and distinguished members of the committee, I am honored to appear before you today to address our efforts to develop our professional space cadre. I am particularly pleased to be joined here by these distinguished flag officers

from each of the services and the Marine Corps. And I would say that we have been working together to make certain that we do in fact address this issue of the professional space cadre in a joint fashion.

In my role of overseeing national security space activities as the under Secretary of the Air Force, director of the National Reconnaissance Office (NRO) and the Department of Defense (DOD) Executive Agent for Space, I am committed to preserving our advantage as the world's leading space-faring nation. I am pleased this committee shares that commitment.

The DOD is working hard to develop the space cadre the Nation needs. We are implementing a space human capital resources strategy to ensure our people have the education, skills and experiences needed to develop space power, and more importantly, to bring that power to bear on warfighting, intelligence collection and other national security needs. The space human capital resources strategy has four goals: First is to ensure the services develop the space professionals they need to fulfill their unique requirements; second is to integrate the space professional development efforts within the national security space community; the third goal is to improve the integration of space capabilities into joint operations; and the last goal is to consistently assign the best space professionals to critical jobs across the Department of Defense.

An integrated strategic approach will help us recognize the services' unique missions while we develop the cadre we need. We are committed to building a total DOD space cadre to meet the needs of national decision-makers and joint and coalition-fighting forces.

The NRO also fits into this concept. The NRO benefits from both its military elements and the expertise of its Central Intelligence Agency members. The NRO's multi-service, multi-agency identity allows the NRO to best serve the Nation by ensuring a focus on national intelligence needs. Within that construct, we will treat the NRO as part of the larger space community.

We have made great progress toward the goals of the space human capital resources strategy. The Secretary of the Air Force approved the Air Force's space professional strategy in July 2003. The strategy has resulted in many positive steps under the leadership of General Lance Lord.

The Navy has also created a Navy space policy document which defines their plan for space cadre development. Vice Admiral Jim McArthur has assumed responsibility for the Navy space cadre.

The Army has initiated a space cadre force management analysis which will define the Army space cadre and identify all space-related roles and missions. Lieutenant General Larry Dodgen has been instrumental in the Army space cadre development.

The Marine Corps has also established a focal point for space cadre management and has in place a mature process for developing space professionals, which Brigadier General John Thomas will describe.

Time does not permit me to discuss all our initiatives in detail, but let me mention a few.

We are holding a DOD space professional development conference to create our education and training framework. We are creating an implementation plan for the human capital resources

strategy that we will provide to the defense committees not later than November 15th of this year.

The NRO is developing a workforce management strategy that will be aligned with the DOD space cadre development programs. A new education with industry program will immerse Air Force members in today's space launch business. And we continue developing complementary space-related graduate degrees at the Naval Postgraduate School and the Air Force Institute of Technology.

Let me discuss for just a moment two challenges we face.

First is a shortfall in systems engineering expertise. We have focused efforts on professional development and identifying best practices to rebuild this critical competency. Our aim is to have our acquirers proficient in sound engineering practices and appropriate risk management decisions.

Another challenge is to ensure that our space cadre in each service is given optimal opportunities for career progression and promotion. We are determined to ensure that the space cadre disciplines do not become stovepipes that stifle development and kill careers.

Our space systems provide us with the asymmetric advantage needed to fight and win, but technology is useless without the leadership, vision, motivation and skills to employ it effectively.

I appreciate the continued support the Congress and this committee provide in delivering these capabilities to our warfighters and national decision-makers. I look forward to working with you as we define and refine the requirements for our space cadre.

Thank you, Mr. Chairman.

[The prepared statement of Secretary Teets can be found in the Appendix on page 49.]

Mr. EVERETT. As usual, your testimony is very insightful and we appreciate that.

At this point, beginning on my right—I always begin on my right, by the way—I would like to have each of the service leaders to explain the concept of the core and critical skills assessed that are required for your particular effort. And I hate to limit you, but if you would be as brief as possible on that, I would appreciate it.

General Lord, we will begin with you, please.

STATEMENT OF GEN. LANCE LORD, COMMANDER, AF SPACE COMMAND

General LORD. Well, thank you, Mr. Chairman. It is my honor to respond to that. Since we last met, we have made I think great progress in answering that question for you.

What we have defined, as you look at the terms of space cadre as it was outlined in the Space Commission report, was really to take a look in our business, in the United States Air Force, that our operators, the people that operate the space systems as well as our program managers, the people who develop the programs, and also the scientists and engineers and acquisition experts who are part of that team—that is part of our space cadre, if you will, as defined by the Space Commission report.

Now, we have extended our definition outside the space cadre to what we call a space professional career field, which are the people that come in and out of the space business and may not stay for

a whole career but are certainly associated with us, the intelligence people who come in, the people who work in the support business, across the skills and abilities it takes to get programs all the way from concept to deployment and actual operation on orbit.

So we have a whole set.

And we have, as part of the process, one of our goals was to identify those in our Air Force and share that definition with our colleagues in the other services. When I last appeared before the committee, I suggested that by the end of the year we would have that all done. I am proud to report that we are way ahead of that and we have categorized over 7,058 people on active duty plus 3,000 Guard and Reserve and civilians in the business.

So we have categorized those folks and identified them by their specific skill levels who are part of the cadre, which is a major part of doing what you request of us as well as what the Space Commission asked and that is to identify the cadre and be ready to understand who they are as they fit into the joint operations area. So we are delighted about that.

[The prepared statement of General Lord can be found in the Appendix on page 60.]

Mr. EVERETT. General Dodgen.

**STATEMENT OF LT. GEN. LARRY J. DODGEN, COMMANDER,
SPACE AND MISSILE DEFENSE COMMAND**

General DODGEN. Congressman, thank you for the opportunity to speak.

As you know, the basis of the space cadre in the United States Army is the Functional Area 40 (FA 40) space experts, numbering today about 150 individuals. They are now training in the Air Force schools, so that integration is under way.

Those 150 people have been to the war and have supported warfighters in Operation Iraqi Freedom and are also serving in agencies such as the NRO and advising in the acquisition process.

The structure to grow them over the next four or five years will in fact double the number of Functional Area 40 officers that we have advising commanders and advising joint force commanders in the field and at installations back in the United States where Army assets can benefit from their products. But that does not answer the question totally in the Army of just how big the space cadre should be. In addition to those Functional Area 40's, there are 3-Yankee skill identifiers that number about 700 additional officers. And then there are the 31-Sierra and satellite communications people that are enlisted soldiers that are also connected with that, and civilians. We have decided that we will need a year, probably, to address those other areas to see if the space cadre beyond the FA 40 should be enlarged to consider all those individuals which have specialties in the intelligence field and in the other fields that will also have space assignments.

So we feel this is important so that we manage their careers properly, and we build this space cadre in an efficient manner.

The basis we have today is our FA 40's, and they are being managed I believe in a way similar to what the Space Commission envisioned when they filed their report.

Thank you very much.

[The prepared statement of General Dodgen can be found in the Appendix on page 67.]

**STATEMENT OF VICE ADM. JAMES MCARTHUR, USN,
COMMANDER, NAVY NETWORK WARFARE COMMAND**

Admiral MCARTHUR. Thank you, Mr. Chairman.

In looking at the Navy's space cadre, the composition of that cadre is mixed. We have individuals with space experience that are arrayed across all activities and commands and organizations within the Navy, and also within the joint world.

We have people who are with Strategic Command, formerly part of U.S. Space Command, the National Reconnaissance Office, individuals who work requirements and assessments on the Navy staff. We have the Navy Network and Space Operations Center in Dahlgren.

So there is a mix, and those skill sets involve anything with intelligence, with acquisition, with science and technology, research and development and operations as well as requirements and assessments.

The basis for that mix has been assignments in space-related billets, that individuals glean experience. It has been the education provided by the Naval Postgraduate School and Air Force Institute of Technology, and even the complementary courses that are available through the Defense Acquisition University.

So the skills are space engineering, space operations, operations analysis and acquisition, that are the underpinnings of the action we need in all those areas.

Thank you, sir.

[The prepared statement of Admiral McArthur can be found in the Appendix on page 76.]

STATEMENT OF BRIG. GEN. JOHN R. THOMAS, USMC, DIRECTOR, COMMAND, CONTROL, COMMUNICATIONS, AND COMPUTERS (C4)

General THOMAS. Mr. Chairman, thank you.

The Marine Corps has made much progress in developing and formalizing our cadre. The cadre is based on the Marine Corps ethos of first and foremost our officers are riflemen.

And what we do is, our cadre is comprised of Marines who have operational experience in a wide variety of military occupational specialties. And then we train them and educate them in space matters.

To give you an idea, we have established two specialty tracks designating our officers either as space operations officers, or space operational staff officers, and they go through a series of training venues to qualify under those categories.

For example, the space operations officer spends two years at the Naval Postgraduate School. We have 21 of those officers on active duty today, and we have nine currently at the Naval Postgraduate School.

In our space operations staff officer, we started that program back a year ago, we have 62 billets that have been identified. We have 40 officers that currently are on active duty filling those billets.

So we have a good program. We think that the program is going to continue to grow as we identify other requirements.

[The prepared statement of General Thomas can be found in the Appendix on page 84.]

Mr. EVERETT. Thank you.

Secretary Teets has mentioned engineering as a shortfall. Would each of you describe your single most needed skill—I assume it would be one that is short; I am just making that assumption—and identify what that is and also what your plans are to fill that? Beginning with you General Lord, if you do not mind.

General LORD. Sir, I would agree with Secretary Teets in his assessment. If we look at our program acquisition team that lives in Los Angeles under the Space and Missile Systems Center, we have a lot of lieutenants but we do not have the captains and majors to fill in in our engineering billets. And that is a big issue for us, to do engineering on new acquired systems and the complexities of the things that we work for in the future.

We have worked hard with Mr. Teets' leadership. We know we are facing overall in the Nation an engineering shortage, and we want to educate and excite people about how important engineering is in our business.

We have been out selectively recruiting. The Air Force has had bonuses for recruiting engineers. We think if we team up with our great partnerships in not only civilian but military institutions as well to help attract people, we will be able to bring them in and excite them about the business.

And that is part of our space cadre efforts, to recruit and retain with wonderful educational programs that provide them what they need to mature through the system.

I think that is our biggest task, to get the engineering content of our acquisition systems built back up to where it needs to be.

General DODGEN. Mr. Chairman, certainly for the 100 3-Yankee individuals that are part of the acquisition corps, engineering is their primary focus. And they are building systems that will facilitate the use of space products to the soldier or advising the Air Force in the building of those space systems.

For the FA 40, engineering is certainly one of the skills that they have in advanced degrees, information system management and just raw things which explain space just as physics and aerodynamics or certainly other advanced degrees that they have.

So what they bring to the warfighter is a thorough understanding of the vulnerabilities and the capabilities that space will bring to the battlefield. And those are the type of individuals that we are growing and uniting with the warfighter for the future.

Admiral MCARTHUR. Sir, just a little different approach on that relative to the Navy.

You asked about shortages in some particular areas. Probably the area that in the relative sense is the weakest is the requirements and assessments process with the Navy staff, and that is determining exactly what capabilities from space offer the best contribution to naval operations in the scheme of maneuver.

So if there is an area where it would be good to build and expand on the expertise, that is with individuals who have space experience, have been at U.S. Space Command, U.S. Strategic Command,

or in a joint force air component commander staff or maritime component commander staff, and then can take that to the Navy staff and work the ops analysis in modeling and simulation of those capabilities and how they fit in to overall Navy and naval capabilities.

That is an area that we need to expand on and grow somewhat. Thank you, sir.

General THOMAS. Sir, the Marine Corps does not have a requirement for engineers or acquirers. Our principal focus is on developing officers that are capable of integrating space into operational planning.

Again, I emphasize the space-smart MagCap officer is what we are after.

Mr. EVERETT. Let me yield to my ranking member at this point.

Mr. REYES. Thank you, Mr. Chairman.

I was wondering, is there a system that you have developed of certification in this area to be able to have benchmarks in terms of the duties or the result of the training for officers enlisted and civilian personnel? Have you given it that kind of structure yet?

If each one of you would comment.

General LORD. Yes, sir, we certainly have. That is part of our cadre development program, is to have a certification process. We put together, under the guidelines of the commission, a certification process that includes three levels—space 100, space 200 and space 300 courses—that you will have to have.

Your basic course, which will be the 100 course, which will last about six weeks at your entry level and then at about the eight-year point you will come back for space 200, which will be a more detailed course that will be about four weeks, and then later on at the strategic level, space 300—those courses have or are under way and will be developed.

Space 100 will kick off this fall at Air Education and Training Command in Texas. We are already teaching space 100, by the way. Our colleagues from the other services helped us validate that course, so we had Army, Navy and Marine Corps, NASA people, we had people from industry who were all part of course development for space 200. We have already trained about 250 people with space 200.

So that is part of having job experience plus the requisite education to be a certified space professional.

And in our identifying the cadre and then being able to track them with a certification process is essential I think to, as you requested and support us to do, grow the cadre in a way that we can recognize who they are, where they have been and what kind of experiences they have had so that we can track them and provide them the right kind of education.

General DODGEN. Congressman, our certification process is based on education also. First of all, they are selected at the major level to come into the FA 40. And when they are assessed into that process, they attend the qualification training that we have of which the 200 course in the Air Force is a big piece of that, and then there are officially certified as FA 40's. And then they immediately must go off to a utilization assignment in a space-related piece.

The 3-Yankee added skill identifier is given, upon completion of the courses, at schools like Commander and Staff College where they get space training but they might still be intel officers or communications officers, and then that gives them a 3-Yankee skill identifier which awards them the identifier but does not necessarily make them go to a space-related position. And that is one of the things that the former really needs to look at, is when they will be officially space qualified.

Admiral MCARTHUR. Sir, on the enlisted and civilian side, as part of the development of our space cadre management plan, we intend to expand the formalized certification and training process.

Now, we have civilians and enlisted that work in many areas: National Reconnaissance Office, working at Dahlgren at our Network and Space Operations Center; Naval Space Operations Center in Point Mugu; as well as U.S. Strategic Command in Omaha.

But most of the time, those individuals have baseline experience and knowledge going into that billet, and there is a tailored certification process to that particular billet that they work with.

For instance, an individual would be ordered into U.S. Strategic Command in a space-associated billet. Once in that billet then the individual will attend a training school, a formalized school, as General Lord alluded to, at Schreiver Air Force Base, and then the experience over the two-year tour allows him to achieve a level that we can designate them with a sub-specialty code for specialization.

Thank you, sir.

General THOMAS. Sir, similar to the Army, the Marine Corps' certification process is based on education as well. The space operations officer being the officer that goes out and spends two years at the Naval Postgraduate School gets a masters degree in space, his first tour after completing Naval Postgraduate School is a three-year payback tour in a space billet, either in the national security space community or on a COCOM staff.

Similarly, on the space operational staff officer side of the house, he attends a course, completes a two-week training period, and then he is assigned to a billet either on the Marine Corps staff or with one of the Combatant Commands (COCOMs).

Mr. REYES. Mr. Chairman, can I yield back to you and I will be back in a couple of minutes?

Mr. EVERETT. Secretary Teets, do we need a standard definition of a space cadre or is there one?

Secretary TEETS. Mr. Chairman, I think there is not a single definition of the space cadre that applies to each of the services and the Marine Corps, and I think that is a wise move.

The mission of the Air Force, as it relates to space and bringing effects from space and warfighting from space and so forth, is considerably different from the role and mission of either the Army or the Navy.

And so my own belief is that this is a case where one size does not fit all. And the definition of the cadre for the Air Force would of necessity be different from the definition of the cadre for the other services.

If you think about the sheer numbers, General Lord now has put together a database that includes some 10,000 people—7,000 active duty and 3,000 Reserve people—that are now part of the space

cadre. That would contrast with General Thomas who has an inventory of something on the order of 60 or 65 Marine Corps people that are part of his cadre.

And so I think to define the term, it is appropriate to have different definitions for each service.

Mr. EVERETT. I must admit, it was quite late when I finished reading all this stuff last night, but it struck me that in some cases, each of the services were talking about the same thing but using different definitions. Does that actually exist?

Secretary TEETS. Well, we could probably work on that. And let me just say that we will be pleased to work at that.

We have a joint oversight council that meets quarterly and we work on problems like that. And what we probably should do is as a joint organization put together definitions that apply to the Air Force, a different definition for the Army, a different definition for the Navy, a different definition for the Marine Corps that fits the needs of each service, but then we all agree on what those definitions are and we have uniform meaning of the terms.

Mr. EVERETT. General Lord, probably more so than any other weapon systems, the development of space systems require a close relationship between operators, users and acquirers. How does the Air Force plan to continue to build the relationship between these consumers?

General LORD. Yes, sir, a very important point for us. As a matter of fact, we are having our new acquisition professionals attend the basic course and be there shoulder to shoulder with the operators. I was visiting up at Cape Cod just yesterday with our team that runs a space warning radar network up the East Coast. As a matter of fact, we have one of the acquisition experts who is on an operations crew up there at Cape Cod and talked to those folks yesterday, and he will go back to the acquisition business after serving a tour in the operations side of the house so he will be better capable of making good decisions about how operations and acquisition interface.

So we see, as the space cadre, one of the fundamental benefits of this is to be able to take people, take the jobs we have in the business—not only in the Air Force, I am sure the Army and the Navy will do the same—and categorize what kind of experience, what kind of cross-feed do you need, what kind of experiences outside the particular areas you might have in a career, and work those on a billet-by-billet basis.

We have identified those. There are about 6,000 billets in the Air Force already, those kind of skills and abilities that will work this problem where we will have the ops acquisition interface, people who go to the same schools, that work the same problems together, that stand shoulder to shoulder as they work, and we think the payoff will be very large in that respect.

Mr. EVERETT. General Dodgen, in your statement for the record, what is the difference between the Army space cadre, which includes only space operators, and the Army space professional cadre that comprises of officers, warrant officers, enlisted personnel and civilians from a wide variety of other areas who are space smart?

General DODGEN. The Army cadre, I mentioned the FA 40's, are giving a very, very broad understanding of space at a very aca-

demic level so they can go out and advise across all the interests of space, not just the capabilities that come to the warfighter but also the vulnerabilities. For instance, how good is GPS on any particular day? Those warfighters can talk to commanders about that.

So they understand the totality of space.

When you are into things like the 3-Yankee and some of these other specialties, they understand a certain level of space but then they are essentially managed by the intelligence branch or the signal branch or the acquisition branch, and so their understanding of space is not as broad as the FA 40 individuals that we put through the rigors of the training I just mentioned.

What we want to do over the next year, without breaking the careers of those officers that just have the 3-Yankee is to understand just exactly what skills they should have in space beyond what they have now, and should they be brought into the space cadre, and should they be managed in a special way other than being managed as intelligence officers or signal officers or acquisition officers in their basic branch, and should there be some integration of those assignments.

You can say the same thing about warrant officers and the enlisted people, such as the 31-Sierras that operate the discuss satellite communication systems, and those are the things that our study will look at. And we will also bring in the institutions to manage those individuals that move into a space cadre in an efficient manner.

Mr. EVERETT. Admiral, let me ask you what funds the Navy has budgeted for fiscal year 2005 and beyond for developing, managing and maintaining a cadre of space-qualified professionals?

Admiral MCARTHUR. Thank you, sir.

We have actually expanded our budget somewhat in modest terms compared to other services. But it has given us the ability to put key people in the right positions to develop the management plan for the space cadre and to execute and implement the plan.

Our intention is to grow from one to two advisers—modest growth but, again, in key positions—that can help facilitate the assignment and management of space-experienced people to key billets throughout the fleet.

Thank you, sir.

Mr. EVERETT. General Thomas, what is the status of the implementation of objectives in the Marine Corps strategy and when will they be completed?

General THOMAS. Sir, I would say that we are probably about 80 percent through our initial implementation of our space cadre. We recognize that we have still some work to do, and we think we have a pretty good head of steam on the fact that in just the last two years—or in the last year alone we have stood up the space staff officer and added that to our inventory as a testimony to that.

So I would say we are about 80 percent with our initial plan.

Mr. EVERETT. Mr. Reyes.

Mr. REYES. Thank you, Mr. Chairman.

You know, as members of this committee, in terms of the armed forces, one of the big lessons that we have learned in recent years is the issue of operating jointly and being able to be a totally integrated force to face whatever challenge is presented.

So in that vein, I am curious, Mr. Teets: Is there a requirement or a need to define—for all the services so that they can be playing under the same either umbrella or the same rules or the same specific I guess job description for lack a better word—in terms of developing the cadre in the three components, whether it be officer, enlisted or civilian? Is that something in fact that would be practical? Or maybe it is and you have already done it? Could you comment on that?

Secretary TEETS. I would be pleased to, sir.

My belief is that we are best served by having each service define their own set of requirements for how that particular service uses space and how it can most effectively organize, train and equip forces that can support joint warfighting operations.

What I see my role as DOD's executive agent for space as doing is pulling together the services and the Marine Corps in a way that allows full visibility across the spectrum.

Because if anything were ever joint, it is space. I mean, space services every one of the services and Marine Corps. All fighting forces are growingly dependent on the use of space assets for warfighting purposes and intelligence collection.

So I think there is a need to have full visibility across all the services as to what each service is doing. But the roles and missions of what each service is doing should not be driven to be the same across the board. That is to say, one size does not fit all.

Mr. REYES. Would any of you like to comment on that?

General THOMAS. I would like to comment on it, sir, just from a Marine Corps perspective, and, again, we have had this discussion before.

Again, on the Marine Corps side of the house, because we do not develop any space systems, so we do not need any acquisition specialties, we do not do any engineering of space. And if you take a look at our construct for building a space cadre, we start with the basic Marine air/ground task force officer and we build on that officer, we educate him, we train him, so he goes back out to the fleet and he is able to take and influence the commander by providing him that expertise relative to space, but at some point in time he may go off to another assignment back into his primary military occupational specialty.

So again, I think Mr. Teets' comment about one size does not fit all is probably appropriate for us.

Mr. REYES. General.

General LORD. Yes, sir, Congressman Reyes, thank you.

What we have done is we have modeled our space operations school in Colorado Springs after the Joint Special Operations University down in Florida, which is really to do just what you said. It has put the inherent people together in a joint environment, to educate and train in that kind of environment to really work, and as Mr. Teets said, space is inherently joint.

So our space 200 courses, which we validated with all the service members here participating and people from their organizations, we put the Army, Navy, Marine Corps, DOD civilians, NASA people all together in the same classroom, and in space 200 in four weeks we were able to give them problems and they worked together as a joint team to help solve the problems.

For instance, we say a combatant commander needs a satellite to do some certain function, you have to design that, you have to figure how you are going acquire it, you have to work together as a service to make the requirements. We go through exercises like that in space 200 and it really builds the joint skills and abilities. We are all not creating individual stove pipe solutions for that; what we are doing is working it together to create a joint educational opportunity that will work that.

Plus, all our service schools, our professional military education institutions, have space as part of their curricula. We learned that in joint operations.

And I think that what you are seeing as a result of the actual application of space in support of war operations is the sum total of what we have been able to do in a joint environment by working together shoulder to shoulder as we grew up in this business.

So I think you are on the right track and we have just got to do more of this.

Mr. REYES. Any other comments?

General DODGEN. Congressman, I would tell you that the more mature space becomes, the more warfighters must act in concert under a full understanding of the capabilities.

In the past, the Army has operated its own training courses, but we fully embrace the National Security Space Institute that General Lord is leading. Our space cadre will be trained there. Our instructors will be there and our doctrine and our expertise will be fully matured within that institution.

I assign all the FA 40's to the positions. The number one priority on assigning those positions is support to the global war on terrorism. Many of those are tactical units that are out there.

We had an Army space support team with the Marines as they moved forward in Iraq. We had an Army space support team with Ambassador Bremer, as he stood up his governing.

The next priority are the joint assignments: STRATCOM, Cheyenne Mountain, NORAD, National Security Space Office (NSSO). The NSSO will probably double in its reorganization as the number of FA 40's that will be in that particular organization. And it is after those priorities that we actually assign individuals to the Departments of the Army (DA) staff and to my own command, Space and Missile Defense Command.

So I think the joint training and interaction that we do together is very, very important as we continue to develop the space cadre.

General LORD. Sir, obviously I concur with all the comments. We are joint. We have joint schools, which the Air Force offers to provide a baseline and a frame of reference for all our service members to work.

It is also particularly important for us in the joint world to understand our adversaries' space capabilities—how do they use it, how can it be influenced and degraded?

So that is important, particularly when we operate in a combatant commander's area of responsibility and in joint operations with the joint maritime component commander, the joint air component commander, that has a mix of all services in it.

So baseline knowledge, baseline experience, our blue force capabilities as well as Air Force area capabilities are important to know.

Mr. REYES. With the challenge that we face today in terms of the war on terrorism, are we seeing any of that impact on your individual abilities to continue forward on this program?

In other words, we know that the Operations Tempo (OPTEMPO) and the rotation going into Iraq, Afghanistan, South Korea and other challenges around the globe are stressing our capabilities almost to the breaking point.

So is that having an impact on you, first of all, personnel-wise; and second, budget-wise?

General LORD. I will take a shot at that, sir.

I think that no direct impact either budget or personnel-wise right now, because the global nature of what we do in space operations, we operate as we do and support operations all over the world all the time, 24/7, 365.

So our centers are really global operation centers to begin with when we are flying satellites or we are supporting with launch to put satellites in orbit, et cetera.

So although we do have an Air Force space command, we have right now about 560 people deployed, most of them to Southwest Asia to support operations in-theater, but that is part of our normal rotational base.

So we are not stressed beyond the normal tempo that everybody is feeling with. I would not say over-stressed or over-obligated resource-wise. We have what we need to do. We are sufficiently challenged, I will tell you that, but we are not to the breaking point.

Mr. REYES. And I guess I should have also included the pipeline. Because any program is only as good as the pipeline that you have got building up, as I think one of you mentioned, you know, you have got to have your sergeants, your lieutenants and so on up the chain of command. So is it having an effect on—

General LORD. Pipeline-wise, we are doing quite well. We are continuing to attract people. We want to make sure and we are working hard to retain all our space expertise. That is where we get competition from industry sometimes and with people who are very skilled and capable.

We think, and I know you will hear this from the next panel, that we think the educational opportunities that go with space education, not only in our Air Force but in the Army, Navy, Marine Corps and Coast Guard as well, the educational opportunities you have as part of the space cadre will certainly be something that you can take with you throughout your lifetime in the service, and people are dedicated to making sure that we have those opportunities.

So right now we are not in trouble in any of those areas.

Mr. REYES. General Dodgen.

General DODGEN. Congressman, we have had soldiers that have gone on multiple deployments as parts of space teams. Because of that reason, the Army realizes it just needs to resource more of these teams, and those teams will grow in the next few years and have already been approved as approved structure.

Actually filling those teams and gaining the expertise, it takes some time to assess the officers into there at the field-grade level and then get them trained up. But that is all on track now.

What we just did for the first time last June was a space support element showed up for the 3rd Infantry Division and it is reorganizing as a unit of execution, X, under our objective force. That is the first time we have had an organic space expertise shell inside one of our divisions. And we plan on doing that for all the divisions, so that is more growth.

Our space support teams have deployed as needed. Now they are going to be organic to the division elements and now we are addressing what will be organic to the core and higher elements.

So that has facilitated some growth.

As to financing those deployments, for the most part they have been funded by global war on terrorism funding, which is basically supplementals from Congress.

Mr. REYES. Admiral.

Admiral MCARTHUR. Sir, I would say relative to the Navy especially—I guess you can say it is unfortunate—but Iraqi Freedom and the aftermath of that has benefited the space mission.

We have individuals who are in positions of being providers for space effects who now deploy to a component commander or to the joint force commander in-theater and become the user.

So relative to the space mission, this has been good in that we understand collectively now the capabilities that space has to offer to joint operations and the joint fight.

So it has not been a negative impact, and it is actually been good because now you have user provider doing both on both sides and have a better understanding in general.

Thank you, Sir.

Mr. REYES. Thank you.

General Thomas.

General THOMAS. Sir, I would just follow up and say this: The global war on terrorism really has driven home the importance of space and the need to have folks that are educated and trained in space.

To give you an example how we prepared for OIF-2. We have had the schoolhouse come out and train our folks and give them special instructions, even prior to them deploying, just to make sure they were aware of how to be able to exploit the capabilities that come with space.

And similarly, we have tried to take advantage of opportunities when the commanders were in town, their supporting the war, and getting them into those places that can better inform on how to exploit those capabilities.

So I think it really has driven home the importance of space.

Mr. REYES. Thank you, Mr. Chairman.

Mr. EVERETT. Thank you.

Mr. Thornberry.

Mr. THORNBERRY. Thank you, Mr. Chairman. And I apologize for being late. As I mentioned to you privately, we had more than one meeting going on at the same time.

I do not want to duplicate questions already asked and may well have questions to submit for the record.

Secretary Teets, you and I have talked before about one of my concerns, which is kind of highlighted in the answers to Mr. Reyes's questions, and that is: Space is seen primarily—and understandably at this time—as a place or way to support operations on the ground. But we also have to be thinking about space as a realm of warfare in and of itself. And if we let the services define their roles, they are not going to do that. They are going to support the other things that they have going on, by and large.

Do we have a push—and we are talking about intellectual development of individuals who are well-versed in space—do we have that push to be thinking about the day when we may well face warfare of some sort or another in space itself?

Secretary TEETS. Yes, sir, I appreciate the question and the opportunity to answer. Because I think we are making real headway in this regard.

The lead role for space employment of force or space defense or space control, as you would say, the lead role is being carried out by Air Force Space Command. Now, that does not mean that they operate in a vacuum, because they do not.

We have National Reconnaissance Office assets, we have Air Force space assets that are acquired by the Air Force and deployed by the Air Force, and we have important critical communication links in space that are actually acquired by the Navy and put into orbit on commercial satellites, on commercial launch vehicles.

And so there is an overall requirement to worry about the employment of force in space, either in a defensive counter-space mode or a space situational awareness mode, or, yes, even thinking about offensive counter-space kinds of capabilities. And that role of space control has been given to our Air Force Space Command people. And it is real clear that that is the case.

And again, we kind of attack this problem in a joint fashion in that we do not exclude Army, Navy, Marine Corps people, we do not exclude the NRO from discussion about it, but the lead role is at Air Force Space Command.

Mr. THORNBERRY. General Lord, let me follow up with you.

Related to that, if you have all of—you or any other, Air Force or any other service—have all these plans and certifications and things to train people in space, it is not going to count unless the decisions made by promotion boards actually encourage people and reward people for focusing on space, and I would say even the aspects of space control that we were just talking about.

So can you tell me that within the Air Force at least that people who devote their careers to space and even space control sorts of issues are going to be adequately rewarded and encouraged so that other people will want to join them?

General LORD. Absolutely, sir. I think that is a very good question and something we need to make sure we look at carefully, and we have across the board.

And I will tell you that Air Force Space Command will be 22 years old this fall and we celebrate 22 years of service. We now have colonels and soon-to-be I am sure generals in our Air Force who started out in that business 22 years ago and they are coming up through the system. I think we are really looking forward to that happening.

Right now we are on par with the rest of the Air Force for promotions for people, looking at the most recent majors selection board, plus some of our own Non-Commissioned Officer (NCO) promotions as well.

So I would suspect—I cannot predict the future, obviously, in this, but I know that those people are very competitive and will be part of the greater leadership cadre of the future.

Our commanders now are people who have come up through the system and are part of that business. So I am excited about that potential. And those who are recognized for starting in the business and staying in the business is part of the cadre.

Mr. THORNBERRY. Mr. Chairman, I may have some other questions for the record, but I yield back now.

Thank you.

Mr. EVERETT. Thank you.

Mr. Teets, I am going to bypass you on this question, but service-specific, would each of our officers tell us the single thing that this committee can do for your service, not the overall space program, but for your service—for the Air Force, for the Army, the Navy and the Marines—as far as space is concerned.

General LORD. Yes, sir, I will answer first.

I think your continued interest and support of what we are doing in the medium of space plus the cadre education process is absolutely right on and we need to continue to emphasize that.

As we shift gears, as Congressman Thornberry raised, as we go from being a force enabling kind of capability to more involved directly as warfare and space has already started, we saw it in Operation Iraqi Freedom with the attempts to jam the global positioning system and we are already there. It is not a matter of if it has happened and we need to be smarter about that. And your continued emphasis as a committee will help us raise the right kind of people and the right kind of framework.

We are like the Navy, we have about 550 people now in Air Force Space Command that have experience in the actual application of space. As in warfare situations begin to deploy to Southwest Asia part of that—that is the cadre that will help us build the kind of rules of engagement and things we need for conflict as it occurs in the medium of space when it happens.

So with your continued support we will be ready for that.

General DODGEN. Mr. Chairman, I would echo what General Lord said about support for this important area.

I would also ask for my own particular case in the Army, where we are looking at this expansion of the space cadre over the next year, that there be some patience as we consider all those areas that are not yet in the space cadre. And one of the primary considerations of taking a year before we report out to the vice chief of staff and he can decide exactly how big the space cadre are career decisions on those other besides FA 40's. FA 40 promotions are higher or equal to the rest of the United States Army, and that is indicative of a group of functionary guys that are growing.

But it is the 3-Yankee guys that are intel, signal, acquisition guys, we have to be careful in their management so that we do not disadvantage them from becoming part of the space cadre.

Mr. EVERETT. Admiral?

Admiral MCARTHUR. Yes, sir.

Again, your interest in this mission area is so important. I think space operations is probably relatively young compared to the other mission areas. But as we transition the department to network-centric warfare, we become more dependent on space at every step of the way. And it is understanding adversaries' space capabilities, it is understanding our capabilities and capitalizing on them and protecting them.

Of course we can have all the technology in the world but we need the expertise with individuals to carry that out.

And, again, your interest, particularly in the space cadre, is most helpful.

Thank you, sir.

General THOMAS. I would agree, sir, certainly the support of the committee for our efforts to build our cadres.

If I were to look at it from an operator's perspective, one of the things that I get hit with every day is the requirement for more bandwidth.

So, you know, speaking for the operators, the warfighters out there, your support in making sure that we get those space programs that are going to provide real capability in bandwidth, like Tactical Satellite (TSAT) for example, those kinds of programs are really the kind of programs that we need in order to transform the force in how we utilize space.

And I could name a few others, but I won't do it.

Mr. EVERETT. Well, gentlemen, thank you all.

And thank you, Mr. Secretary. Your input has been very helpful to us. And I also want to thank you for your contributions to this frontier that is going to be an overwhelming part of our lives in the future.

It is something that we must get ready for, and I thank you now.

We will now seat the second panel.

Thank you.

I would like to reintroduce the second panel. This panel includes representatives from industry, military academia and civilian academia. As such they will provide their perspectives on the development of space professionals for the purpose of military space. Each of the panel members will give a short—please, three minutes only—oral statement. Your complete statements will be entered into the record, and then we will begin the question and answer period.

The members of the panel are: Dr. Robert Calico, Provost, Engineering and Management Department, Air Force Institute of Technology; Captain Dan Bursch, USN, Associate Dean of Graduate School of Engineering and Applied Sciences, Naval Postgraduate School; Dr. John Douglass, President and CEO, Aerospace Industries Association; Dr. Pam Shockley-Zalabak, Chancellor, University of Colorado at Colorado Springs; and Dr. Victoria Coverstone, Professor of Aerospace, University of Illinois at Urbana-Champaign.

Again, I ask you to please keep all statements within three minutes. We will put your entire statement into the record. That will allow us to get to some questions which we are anxious to submit to you.

And I would also point out that we do expect votes in about 20 minutes or less, and if we could probably get through with the oral statements then we will take a recess and come back for the question and answer period.

So we will begin on my right, the panel's left, and just go right down the line.

Dr. Calico.

STATEMENT OF ROBERT A. CALICO JR., PROVOST ENGINEERING AND MANAGEMENT DEPARTMENT, AIR FORCE INSTITUTE OF TECHNOLOGY

Mr. CALICO. Mr. Chairman, distinguished members of the committee, on behalf of Colonel David Eidsaune, Commandant of the Air Force Institute of Technology, it is my pleasure to talk with you today about the education of the nation's military space professionals.

As the Space Commission highlighted in its 11 January 2001 report: Military space professionals will have to master highly complex technology; develop new doctrine and concepts of operation for space launch, offensive and defensive space operations, power projection in, from, and through space, and other military uses of space; and operate some of the most complex systems ever built and deployed.

The key difference between military space professionals and those involved in civilian space programs is the focus on specific military uses of space highlighted by the report.

Space science is fundamental to both communities. It is the fusing of space sciences with technology, doctrine and tactics that allows the space professional to accomplish assigned military objectives. AFIT understands this very well as it executes its educational mission.

AFIT's response to Air Force needs in space education resulted in significant and successful initiatives and programs from its beginning. As early as 1957, as the Nation and the Air Force responded to the launch of Sputnik, space-related courses were added to existing curricula, and the first class of the Astronautics program—later renamed Astronautical Engineering—started in 1958.

Responsiveness to Air Force and national defense needs is resident in AFIT's mission and what we have demonstrated successfully for many years.

As a more recent example, AFIT initiated the Graduate Aerospace and Information Operations program in the fall 2001 as a direct response to an Air Force Space Command request to add information operations to our space operations program. This program retains the technical foundation of space science and engineering courses but also provides students with an understanding of how information is used, conveyed, assured and denied.

In the fall of 2003, AFIT expanded its offerings under the Graduate Space Systems program. Under this program students take a common space core and augment it with tailored sequences to meet specific customer requirements such as systems engineering, information warfare and operations research.

This program is designed to provide the space cadre with a broad knowledge in space systems engineering and space science, includ-

ing the ability to plan, execute and valuate space systems in operation.

The space systems graduate is ready to participate actively in the organization's responsibility for selecting, planning, management, operations and evaluation of space systems for DOD.

AFIT has a significant history in participating in space education. We enthusiastically continue to support this through participation in the space professional development integrated product team, collaborating with Air Force Space Command, the Space and Missile Center, the National Reconnaissance Office and others.

We are also embarking on a new and exciting partnership with the Naval Postgraduate School to take advantage of the strengths each school can bring to the education needs of the space cadre.

In conclusion, AFIT is a flexible, responsive institution well-suited to provide relevant defense-focused education for the 21st century warrior.

Thank you for your time, and I look forward to your questions.

[The prepared statement of Mr. Calico can be found in the Appendix on page 92.]

Mr. EVERETT. Thank you, sir.

Captain Bursch.

STATEMENT OF CAPT. DANIEL W. BURSCH, USN, ASSOCIATE DEAN OF GRADUATE SCHOOL OF ENGINEERING AND APPLIED SCIENCES, NAVAL POSTGRADUATE SCHOOL

Captain BURSCH. Mr. Chairman and distinguished members of the committee, as well as an associate dean, I am also a naval astronaut and instructor in the space systems curriculum at the Naval Postgraduate School (NPS).

I have to say right now my heart is beating about as fast as when it was before launch. [Laughter.]

On behalf of Rear Admiral Patrick Dunne, the superintendent of the Naval Postgraduate School, and Dr. Rudy Panholzer, chairman of the Space Systems Academic Group, who is with me here today, thank you for the opportunity to talk to you about the Naval Postgraduate School's continuing role in the education of America's space cadre.

I am also honored to be a part of this distinguished panel.

In 1982, the Naval Postgraduate School, also known as NPS—that is just what you need, another acronym—formed the Space Systems Academic Group, an interdisciplinary group of faculty with the vision to serve Naval and DOD's space educational requirement.

In the past 20 years, we have graduated over 560 Navy, Marine Corps, Army and Air Force officers in our space systems engineering and operations curricula.

Having achieved a comprehensive understanding of space systems architectures and employment, these students applied their expertise in a wide variety of acquisition and operational space billets in the fleet and joint commands and in national agencies.

The school's early recognition of the value of external partnerships led to the formation of a faculty chair position sponsored by NASA, Navy Space, the National Reconnaissance Office and our industry partners.

We also have an Air Force military instructor.

These diverse participants with real-world experience and expertise provide an invaluable resource for our joint student body.

Through regular curriculum reviews with senior leaders, we have maintained a flexible curriculum highly tuned to the needs of both DOD and national security space.

Our lab facilities are a model of cooperative efforts with the NRO, Naval research labs, the Air Force research labs and others. Our students have the opportunity to take classified courses and perform classified research or pursue hands-on research building spacecraft, such as the petite amateur Navy satellite spacecraft built at NPS and launched in 1998 from the space shuttle Discovery.

Recent programs created as a response to DOD needs include a space distance learning certificate program to provide space education to military members worldwide as well as an educational alliance with the Air Force Institute of Technology.

In closing I wish to thank the committee for your ongoing support to our nation's security, to our nation's space programs and to all of us in uniform.

The Naval Postgraduate School stands ready and able to provide education programs that meet our nation's needs.

Thank you.

[The prepared statement of Captain Bursch can be found in the Appendix on page 101.]

Mr. EVERETT. Thank you.

Mr. Douglas.

STATEMENT OF JOHN DOUGLAS, PRESIDENT AND CEO, AEROSPACE INDUSTRIES ASSOCIATION

Mr. DOUGLAS. Thank you, Mr. Chairman. I appreciate this hearing today. I am particularly mindful of your time and the other committee members' time, so we really do appreciate this.

My comments today are a little bit—

Mr. EVERETT. Let me interrupt and say we very much appreciate your time. If you feel that I am sort of giving you a short time to say what you need to say, let me assure that you will be glad of that later on when you see these votes start coming in.

Mr. DOUGLAS. Yes, sir. Well, I have been coming up for almost 40 years, sir. I started way back there in the back, so I know how things work, especially this time of year. We are mindful of your time.

But my comments today really come to you from kind of a diverse background. I am a former Air Force general, I am a former commissioner on the Commission on the Future of the Aerospace Industry, appointed by President Bush, a former Assistant Secretary of the Navy and currently the CEO of the Aerospace Industries Association.

I am mindful of some answers you got from the first panel. I should have added to this my comments as we started. You were asking them about space cadre, and their answers to you covered really two areas: one, the development of new space systems, and that is kind of one area that the cadre is in, and then the other is the operation of the space systems once they are up there.

And as you know, sir, industry is primarily associated with the development of the new systems, but we are associated, both in the Air Force and at NASA, in the operation of space systems, but our primary mission is the development of those new systems.

My first point to you is this, sir: that the nation, not just these military services that you spoke to in the first panel, are facing a very difficult challenge in human capital in the space area.

Just to put that in a little bit of perspective: In 1963, when I graduated as a young engineer and went into the Air Force, one-third of the science and engineering graduates all over the United States went into aerospace careers, either into one of the military departments or into industry. Today that percentage is hovering somewhere around two percent. So we have gone from one-third down to two percent.

Also, in 1963, in the development of new aerospace systems, we had somewhere in the neighborhood of 140,000 to 150,000 scientists and engineers working here in the United States on new systems. As a young second lieutenant going into the Air Force's development systems, I had many, many space and aeronautics bomb programs that I could work on. Today we have in our whole country less than 20,000 scientists and engineers working in aerospace research and development jobs. So we have gone from somewhere between 140,000 and 150,000 down to around 20,000.

The second point I want to make is that the military, and indeed the other services who spoke to you this morning, are not going to compete well in this very difficult future that is coming unless they do something about improving their promotion rates.

And without trying to pick on my good friend, General Lord, because he is a friend and someone I deeply respect, for him to tell you about the Majors board, sir—I mean, you know, who does not make Major these days?

The real criteria is whether you make full colonel or brigadier general. That is when you are really beginning get into the full leadership of the department.

So I would recommend to you that if you set criteria for the military services in developing within their military a leadership criteria for the future that you look very carefully at the promotion rates to full colonel and brigadier general.

These lower-rank promotion rates are certainly important when you are going up for promotion, and I do not mean to denigrate that, but the promotion rates are very high at those lower levels.

My last point is, sir, that industry sees this through the eyes of the President's commission that made its report last year. We think this is an extremely complex national problem. It involves our national ability to compete across a broad spectrum of technologies. Space is one that is enormously important to us. To solve it, it requires the Federal Government, our states, our industry and our academia to work together.

We are developing a national plan to do that at the Aerospace Industries Association in cooperation with the Administration and with our States.

We appreciate your asking us to come today, and we will be glad to answer any questions you may have, sir.

[The prepared statement of Mr. Douglas can be found in the Appendix on page 109.]

Mr. EVERETT. Thank you.

Dr. Shockley-Zalabak.

**STATEMENT OF DR. SHOCKLEY-ZALABAK, CHANCELLOR,
UNIVERSITY OF COLORADO AT COLORADO SPRINGS**

Dr. SHOCKLEY-ZALABAK. Thank you.

Mr. EVERETT. That close enough?

Dr. SHOCKLEY-ZALABAK. Close enough.

Mr. EVERETT. Thank you.

Dr. SHOCKLEY-ZALABAK. Good afternoon, members of the committee. Thank you very much for allowing me to talk about our efforts at the University of Colorado at Colorado Springs to contribute to the important role of space professional development in all aspects of space systems design, implementation and operation.

Because of its close engagement with the community of Colorado Springs, including the United States Air Force Academy, Peterson Air Force Base, Schriever Air Force Base, Fort Carson, NORAD and Air Force Space Command, and now U.S. Northern Command, CU-Colorado Springs is uniquely positioned to assist in the development of space professionals. And in fact we have been doing so really since the mid-1980's.

Our Network Information and Space Security Center is widely recognized for its supportive organizations such as U.S. Northern Command, Air Force Space Command and Air Force Research Laboratory.

The mission of Network Information and Space Security Center (NISSC) is to facilitate cooperation and collaboration among constituencies in federal, state and local government agencies, the military, academia and industry.

NISSC and our university departments currently offer graduate level certificate programs in homeland security, information assurance and secure software.

NISSC also has been a founding member of the Homeland Security/Defense Education Consortium where over 30 academic institutions have come together to meet national needs.

Our newest initiative is specifically in support of developing and expanding the professional space cadre. CU-Colorado Springs has formally agreed to serve as the designated higher education representative for Air Force Space Command for the purpose of establishing and managing a consortium of premier research institutions and other appropriate organizations to serve the broad educational needs of the military space community.

The goal of the space education consortium is to be recognized as a national and international organization of excellence for space education to achieve national security needs.

The consortium's interest will include a broad spectrum of space operations in all environments. Underpinning the consortium will be a series of agreements that allow students to take courses from consortium members, plan educational programs, transfer credits among member institutions and receive degrees.

The tenets of the consortium include making sure that the military space role and perspective is adequately and accurately re-

flected in educational initiatives; to promote and facilitate program development in space-related areas; to facilitate space-related research and development; and to create the kind of cooperation among consortium institutions that will allow us to expand training, development, research and educational opportunities for space professional development.

The university's approach to consortium membership will be inclusive and will include higher education institutions, military schools and educational institutions and other organizations that foster the advancement of space.

We share the committee's view that this is very critical, and we will work collaboratively in support of meeting our current needs as well as our future challenges. Thank you.

[The prepared statement of Dr. Shockley-Zalabak can be found in the Appendix on page 116.]

Mr. EVERETT. Thank you.

Dr. Coverstone.

STATEMENT OF DR. VICTORIA COVERSTONE, PROFESSOR OF AEROSPACE, UNIVERSITY OF ILLINOIS

Dr. COVERSTONE. Mr. Chairman and members of the committee, I am Victoria Coverstone, professor in the department of aerospace engineering at the University of Illinois at Urbana-Champaign.

I appreciate the opportunity to appear before you today to discuss a subject of critical importance to the security of the United States: the education and training of young men and women in the knowledge and skills needed to achieve military and scientific objectives in the space arena.

My message to you today is that the pool of talented domestic students interested in careers in space remains large and highly motivated. But the lack of financial support and pipelines to these careers too often divert them into other fields of study.

The University of Illinois is known for graduating large numbers of students with bachelors, masters and doctoral degrees in aerospace and aerospace-related fields. Illinois is one of the highest ranked engineering colleges in our country and our students are among the nation's best. But just as important is the high motivation of these students for space careers with the military, NASA and industry. All of our students consistently show that they have been dreaming of careers in space as astronauts, engineers and scientists since age 10 or even earlier. The strong motivation of these talented students represent the tremendous resource for the future of space development.

It is our opinion that this student resource is being severely under-utilized. Our best students sometimes have difficulties putting themselves through school. More scholarships, fellowships and research dollars, as well as job offers upon graduation, are needed to increase the number of space professionals. I hope you agree that much more must be done in supporting these students.

I want to report to you today that the University of Illinois strongly supports our efforts to educate these excellent young students in space science and technology. We offer a broad-based education in aerospace fundamentals, but opportunities for education and space-related disciplines are much more than classroom lecture

courses. We also stress the importance of hands-on experience. For example, our multidisciplinary Illinois orbit-observing nanosat project offers undergraduate and graduate students a creative window into the practical space mission design.

We also heavily emphasize teamwork skills as highlighted in my department's two-semester senior design course. And I am proud to say that these system designs always do very well at the national level, in some years bringing in first, second and third prize.

The University of Illinois is the lead institute for the NASA space-grant college and fellowship program in our state. The space grant brings together the research efforts of the University of Chicago, Northwestern University, the Illinois Institute of Technology, and of course my university to support research and to provide student support in space research.

My university's latest effort is the establishment of the Center for Human and Robotic Space Exploration with the purpose to train future leaders and develop the fundamental scientific and engineering expertise needed to achieve our vital national goals.

In conclusion, my message to your committee is that my university very strongly supports national efforts to develop space capabilities and educate and train first-rate students. All that is needed is the financial support for those already motivated students anxious for careers as space professionals.

[The prepared statement of Dr. Coverstone can be found in the Appendix on page 120.]

Mr. EVERETT. Thank you.

I thank all of you.

I am going to yield my first round to Mr. Thornberry.

Mr. THORNBERRY. Thank you, Mr. Chairman.

Mr. Douglass, I want to ask you this, because all of us who really care about space have our stomachs turned every time we have a hearing or more often read the newspaper about the latest cost overrun, the latest delay in some sort of system development, the latest technical problem, and it seems to happen with pretty much every major space acquisition system.

Now, this is not the hearing to get into all of the reasons for that. But what I want to ask you is this: is part of the problem that we have not developed the proper expertise in the military folks who are procuring and overseeing the research and development and procurement of these major space systems?

Mr. DOUGLAS. Yes, sir, it is part of the problem.

Mr. THORNBERRY. And what do we need to do to fix it, because it is a major, major problem it seems to me in trying to move ahead on space?

Mr. DOUGLAS. Well, you know, I think the most practical thing that the Air Force needs to do, if you are referring to that service as compared to the Army and the Marine Corps, is to look a little bit toward the way the Navy handles some of its particular mission needs.

I guess the best example that you might want to look at is the Navy's nuclear propulsion program where you get specialized training and they stay in that career field all the way on up to be in the lead submariner in the Navy. And of course they have other specialized programs for their technical officers.

The thing that I would watch, if I was most trying to track this from your point of view, would be what was pointed out by the Rumsfeld Commission, which is that if you look at the top number of people that are involved in space operations and space acquisition, if there is a relatively low number of them that came up through the system—in other words, they came into the system already being a general officer or a senior executive from somewhere—then you might ask yourself why is that, why are not the ones we trained in that technical skill getting promoted to those top jobs? And that is where I think you need to really keep your eye on the ball.

That is why I said promotion to full colonel or captain in the Navy, or into flag rank, is the real, real criteria. If they do not promote them at that level, then you know you got a problem further down—I mean, if they do not get promoted further down, then God knows we are really into a disaster.

Mr. THORNBERRY. Thank you.

Mr. EVERETT. Well, this is kind of what we were—unfortunately we are waiting for just a comment. I think it is an excellent question that our colleague asked. I assume Mr. Douglass that your answer is to keep them down on the farm, so to speak. We have to make the promotions quicker.

Mr. DOUGLAS. Well, sir, you know, the military services always have the problem that their main mission is combat. And you heard what the young Marine general said. God knows there are no finer Americans or finer officers on this planet than our young Marine officers. I have been associated with them all my life and I continue to be amazed at the quality of young people we get into those jobs. So they start as a rifleman and they kind of go from there.

Well, that line of thinking to a certain degree extends across all the services. In the Air Force it is, you know, you are a pilot, you can do anything. And it is something else perhaps in the other services.

But you do have to, when you have a part of the military establishment that has got to have deep technical skills and insights into how those skills relate, technology to operations, if you are not careful you can drift far too much into pulling all of your resources off the operational side of the house and not enough off the technology development side of the house, and that is just where your colleague is aware that we do have problems. And I think there have been a number of commissions and panels that have—distinguished commissions and panels that—have illustrated that problem, including the Rumsfeld panel.

Mr. EVERETT. I now recognize our ranking member, Mr. Reyes.

Mr. REYES. Well, thank you, Mr. Chairman.

I was intrigued by your observation, Mr. Douglass, in terms of how we have gone from I believe it was one-third to 2 percent in terms of being interested. Isn't that also reflected in general terms in the general population? And I say that because I know, my wife is an educator and my daughter is an educator as well, and one of the hardest challenges faced by education today, from what we see and what they tell me, is getting students proficient in science and

math and the kinds of core courses that actually feed into space and these kinds of careers.

I reflect back on the initial space race, when the Russians put the Sputnik up and then President Kennedy declared that we are going to put a man on the moon before the end of the decade, and the excitement that that generated, I am old enough to tell you that I was young enough then to think that, man, that was the coolest thing in the world, to be on top of this rocket ship that could explode and get into outer space and be able to—that was the initial part of television coming into its early days and its heyday.

So my question is: Do you have any recommendations on how we can ignite that same kind of interest, the same kind of motivation. Because certainly from what we hear, monetary compensation is not one of the motivators there because you have people that are willing to go into outer space that do not necessarily get motivated by money.

So do you have any recommendations or observations?

Mr. DOUGLAS. Yes, sir, I do. I was fortunate enough to be one of President Bush's commissioners on the Commission on the Future of the Aerospace Industry, and we looked at this. And as you know, subsequent to that there has been yet another commission which recently gave its report on the structure of the president's new space program. And industry is very concerned about this.

One of the things that we do is to create a rocket contest for young kids to keep them interested through high school. Because, sir, if they do not fight their way through Algebra I and Algebra II, my colleagues to my right and left are never going to see them, because they are not going to come to these wonderful universities and learn how to be a scientist or an engineer and work in this aerospace field.

But another part of motivation is: We have to have a program, we have to have dreams for the future. And the president's new space initiative, you know, to go back to the moon and eventually onto Mars and to build a replacement for a shuttle, it is so important that we have those as national objectives, even though, sir, you know, we all know we have a deficit, we have the war in Iraq, we have other things, we have to have that dream or our young people, are just not going to go into this. Because our children are enormously more sophisticated than we were when we were young.

I have an 8-year-old son and a 6-year-old son. They know how to surf the Web. And they love space-type things. But they are smart enough to know that if there is no space program out there in the United States, they better go into the medical field or they better, you know, study computers or something else.

And so we have to have a national program, but then we have to keep the kids engaged. And industry is willing to do its part in that respect, and we want to be in a cooperative program with our colleagues from academia, with the Federal Government and hopefully with our Congress.

But you got to have that dream, you got to get them motivated. And then, sir, you got to get them through Algebra I and II in high school. If they do not do that, they cannot do any of this stuff.

Mr. EVERETT. I am going to have to interrupt at this time.

This is our effort to help you beat the clock so you won't have to sit here so long, but we only have about eight minutes left to rush over to the floor and there will be a series of three votes, which will be a minimum of 25 minutes to 30 minutes we will be gone.

So I am going to recess the hearing at this point.

Thank you.

[Recess.]

Mr. EVERETT. The meeting will come to order. I ask the panel to reconvene, please.

Captain Bursch, will you please explain your vision of a joint space advisory group?

Captain BURSCH. Yes, sir, Mr. Chairman, I would be pleased to.

The Joint Space Advisory Group, or academic group, was initially formed as part of the AFIT-NPS alliance. When we first started getting together at the end of February of this year, we quickly realized that the scope of our charter would probably end up expanding beyond AFIT and NPS, not just to look where graduates go after our schools, but also looking at what we are getting from service academies and other institutions.

And along with the Joint Space Oversight Board, their charter has been expanding too.

So as far as between the two schools, some of the elements of a future state that the Joint Space Oversight Board has asked us to do is to come up with some recommendation on the right percentage of the space cadre with graduate degrees, including recommendations on the right percentages in each technical curriculum, also recommendation on the necessary through-put in capacity of each institution, and also recommendation on how we ensure that the graduate degree programs of the academic institutions meet the needs of the national security space community.

One thing that seems kind of mundane—actually one of the things we have been working on—is developing some set of definitions for space terminology. Already today I have seen confusion when people say “operations,” or when people say “operator,” somebody may think of a warfighter and other people may think it is somebody operating a satellite.

So there is a lot to be gained in looking at definitions.

Another thing that we are trying to do—another goal, at least would start in AFIT and NPS, which we think will expand to other institutions and other members—would be to somehow develop some type of common set of educational objectives. At NPS we call them educational skill requirements and that is how we build our curricula at the school. We also look at accreditation considerations. I am sure that every organization, institution out there does a similar thing.

If we could come up with some similar way or process of doing that, I think we could make long strides in educating the total space cadre as far as graduate education.

Our focus will be mainly on graduate-level education.

I can go into some others, but those are the main areas, sir.

Mr. EVERETT. I appreciate it.

Dr. Shockley-Zalabak, in relation to how they may be used to develop space cadre and space professionals, please tell us about the

Network Information and Space Security Center concept and the space education consortium: Who are the participants and what is their contribution? What is the charter and intended contribution of the space education consortium?

Dr. SHOCKLEY-ZALABAK. Well, thank you for that question.

Our Network Information and Space Security model has been a partnership model from the very beginning. Academic partners, military partners, industry partners have come together to identify needed certificate programs. And using that partnership model, we have actually been a founding member of the homeland security/defense education consortia.

That model will then go into the space education consortia model where, again, we are looking at participating institutions around the country that have space education and research programs and want to be active contributors to not only looking at research that is very relevant to our military space needs, but looking at the kinds of programs that are needed, both at the undergraduate and at graduate-degree levels where service personnel can seamlessly work between institutions, among institutions to achieve degrees.

Some of the initial people who are discussing this partnership in collaboration over the last 18 months are the University of North Dakota, Johns Hopkins University, George Washington University, the Space Foundation as well as Aerospace Corporation. And included in some of the consortium activities will be an emphasis on the K through 12 pipeline that Mr. Douglass discussed earlier where in fact we need to engage more young people in middle school in thinking about these kinds of opportunities.

They are looking for active members, and we are quite confident that there are many in the Nation who want to be contributing members to this consortium, which will strengthen all of the branches of our service.

Mr. EVERETT. Dr. Coverstone, speaking of the consortium, are you aware of any similar efforts in the Midwest or eastern United States similar to that which is headed up by University of Colorado?

Dr. COVERSTONE. Yes. The Illinois space grant, which is a part of the NASA national program, space-grant program, we are actively involved in linking local and state government agencies, industry as well as colleges and universities. And actually the two of us have been discussing a way in which we can even become stronger by collaborating.

Mr. EVERETT. The two of you, then, there seems to be a great shortage in higher trained and educated individuals coming out of our universities to support a robust group of space professionals in the military, industry and academia. What efforts would you find valuable in encouraging qualified students to pursue a professional career in the space arena?

It seems to me it is such an exciting, and I use the word again, frontier that is going to consume so much of our lives in the future that this would be a very exciting field for young people to get into.

I understand they have to pass algebra first.

Dr. SHOCKLEY-ZALABAK. And algebra is kind of where we need to start.

We have a new program called Partners for Change that we have a memorandum of understanding with Space Foundation, and we have corporate partners and others that we are discussing where we are going to go into middle schools, work not only with students about a pre-collegiate curriculum in science technology, engineering and mathematics, but work with their families and also work with re-inventing curriculum that addresses why those subjects tend to turn students away from what is obviously a very exciting career opportunity.

So it is not only reaching young people sooner; it is working in teacher training, it is also working in re-certification of certain kinds of curriculum that really meet these needs for the future.

But it is also financial support for students, as in fact Dr. Coverstone indicated earlier.

We have many pilot programs throughout the country that have done an excellent job, but we need a more comprehensive strategy that we in fact have evaluated over a period of time. We have never had greater interest in space programs that are university-based in the summertime. And we have declining participation all over the nation, and not just in Colorado Springs, although we have perhaps less of a decline than some others, we have declining participation all over the Nation in some of those degree fields, which of course becomes the space professional cadre of the future.

Mr. DOUGLAS. Mr. Chairman, could I comment on that a little bit from a national perspective? I thought it might be helpful to you——

Mr. EVERETT. If you would briefly because we are running up against a time deadline where we are going to have to call the hearing to a close.

Mr. DOUGLAS. Just to put in perspective, we have somewhere around 575,000, 585,000 workers in the aerospace industry today. That workforce, just looking at what we see coming now, is going to go up to about 610,000 by 2006. And our workforce is in its early 50's in terms of age. Engineering workforce is probably about 55. The blue collar workforce is about 52. So we are going to see between now and the end of this decade a large number of them retire.

What we do not have—and this strikes to your question about my two colleagues here working together—we do not have a national model that relates the jobs that we need in this country to the output of our colleges and universities in the programs that my colleagues on the panel are talking about, and that is one of the things that we are working with the Department of Labor to produce, is some sort of input-output model for the Nation as a whole so we know how many software engineers do we need, how many aeronautic engineers, how many astronautic engineers and so on. There is no national model as we speak, sir.

Mr. EVERETT. I thank you for that. Dr. Coverstone, I had asked you for a response for that and I think you also were preparing to give one.

Dr. COVERSTONE. Well, the words that I have heard resonate within myself, the only thing that I would like to add to that is the excitement with President Bush's space exploration initiative, and we are hoping that an appropriate percentage of the budget that

is targeted for that will actually help go toward training of this workforce that will be required and not just go directly to the hardware in supporting the programs themselves.

So we are hoping to build upon that vision. It is exciting and it is something that the students are behind and we hope to capitalize on it.

Mr. EVERETT. Thank you.

Dr. Calico, how should your programs adapt to the increasing needs of a space cadre? Do you have the focus to satisfy the requirements of developing a space cadre? Should your space-oriented programs be open to a larger number of students? Do your programs significantly address needs of intelligence for the purpose of national security space?

That is a lot of questions, but if you could take a poke at it.

Mr. CALICO. Yes, at my age, remembering four things might be difficult—

Mr. EVERETT. We will come back.

Mr. CALICO [continuing]. But I will try.

Really, I think this would be true for both us and the Naval Postgraduate School.

I think we have a strong system to respond to identified needs in certainly the DOD space community.

But one thing I would say, I do believe that as the development of the space cadre from concept to employment that they are working at, we are more at the concept stage. While I think the space 100, 200, 300 are great, I think setting the requirements from the services' point of view in a joint manner for degree graduate education is still something we need to spend a little extra work on.

I do think processes are in place to develop the curricula as required. I think we have both had a long history of doing that.

In terms of meeting the needs of the intelligence communities, that is certainly a focus of our program in some of the areas. And by the intelligence community, now, I would be speaking at a broader intelligence community—the NRO, the National Geo-Spatial Intelligence Agency, the DIA as well as CIA. We have a strong connection with the NRO. We run a program in an area termed nascent measurement intelligence which is simply paid for by the National Geo-Spatial Intelligence Agency and is strongly connected to their requirements and its really employment collection techniques they are using as space assets.

And then finally in terms of a wider audience, I think our focus is the defense community. And certainly we believe there is an increased and a growing need to educate all segments of that community. The popular term I think in the Air Force is total force, and total force means that its not only our officers, it is our enlisted, it is our civilian workforce, and increasingly it is our contractor base.

And many of the things that we are involved with in areas like intelligence or in some of the space program delve into areas where foreign disclosure is an issue, where security is an issue, and in those areas we do think there is a need for broadening that base a little bit.

I think I touched all of them but I know not to have.

Mr. EVERETT. You are remarkable, you did.

And I regret we have run up against the time restraints for my colleague and I. I hope you will consider the fact that your written statements, I read through every single one of them. It was late last night when I got through. The book is this thick. And the staff has read through all those statements. And they are most helpful to us in trying to figure out where to go and how to do this.

I will tell you, though, that we do have additional questions that we would like to submit to you, and we would like as timely answers as you can give us, preferably in the next 30 days. That will give us the answers by the time we get back from the traditional August work period, not recess. [Laughter.]

I do not understand that term.

So I again want to thank you very much for your kindness in being here today. It was well worth it for us for you to make the trip. We need the kind of input that you have given us. And again, I appreciate it very much.

The meeting is adjourned.

[Whereupon, at 4:32 p.m., the subcommittee was adjourned.]

A P P E N D I X

JULY 22, 2004

PREPARED STATEMENTS SUBMITTED FOR THE RECORD

JULY 22, 2004

Opening Statement
The Honorable Terry Everett
Chairman, Strategic Forces Subcommittee

Hearing on the Development of a Space Cadre

The hearing will come to order.

The Strategic Forces Subcommittee meets today to receive testimony on the development of a space cadre—a group of space professionals from all areas: military, industry, and academia. I want to welcome all the witnesses who have agreed to share their expertise with us today on this important topic to the subcommittee.

For our first panel today, I want to welcome Undersecretary Pete Teets who is testifying today as the head of National Security Space Programs. I also want to welcome the Service Space Program heads:

- Representing the Air Force, General Lance Lord, Commander, Air Force Space Command;
- For the Army, Lieutenant General Larry Dodgen, Commander, Space and Missile Defense Command;

- For the Navy, Rear Admiral James McArthur, Commander, Navy Network Warfare Command;
- and Brigadier General John Thomas, Director of Command, Control, Communications and Computers (C4), and Chief Information Officer (CIO) for the Marine Corps.

Following the remarks of Mr. Teets, I will invite the committee Members to ask questions.

For our second panel today, I want to welcome representatives from the space industry as well as academia.

Testifying will be:

- Dr. Robert Calico, Provost of the Engineering and Management Department, Air Force Institute of Technology
- Captain Dan Bursch, United States Navy, Associate Dean of the Graduate School of Engineering and Applied Sciences, Naval Postgraduate School.
- Mr. John Douglas, President and CEO, Aerospace Industries Association.
- Dr. Pam Shockley-Zalabak, Chancellor, University of Colorado at Colorado Springs

- And Dr. Victoria Coverstone, Professor of Aerospace, University of Illinois

We have a great deal of ground to cover today, and I want to allow each of our Members as great an opportunity as possible to ask questions, so I will be brief. Likewise, I would ask you all to be brief with your prepared remarks – the entirety of your written statement will be entered into the record.

The development of a Space Cadre was a major thrust in the findings of the Space Commission's 2001 report. The report emphasized the need to create and maintain a highly trained and experienced cadre of space professionals who could master highly complex technology, as well as develop new tactics and doctrines for space operations in the future. Slowly, the development of a space cadre has evolved.

In an effort to encourage the process, the National Defense Authorization Act for Fiscal Year 2004 directed the Department to develop a strategic plan to coordinate and facilitate the development of space personnel career fields and integrate them into the larger personnel systems of each service. It also directed

each service to develop and take a more proactive stance in the development of its individual space cadre.

The committee is concerned about the breadth and depth of the current Department of Defense plan. It seems to lack sufficient detail and structure for implementation.

Additionally, in the area of education and training as well as in addressing the role of academia and industry in the space cadre, the committee has concerns. The committee believes the accumulation of skills and the competencies of government, academia and industry represent a comprehensive view of the military space community for the United States. Each has valuable tools and expertise to contribute, and we all look forward to hearing the witnesses suggestions on how this talent and culture can best be cultivated and incorporated into the development of a space cadre in the military and of space professionals at large.

Today, I look forward to exploring the status of each of your efforts and sharing ideas on potential solutions to developing today's space cadre and tomorrow's space professionals.

[Recognize Chairman Hunter and Ranking Member Skelton if present]

Now I would like to recognize my friend and distinguished Ranking Member, Mr. Reyes, for any comments he may have.

[Following Mr. Reyes remarks]

Thank you Mr. Reyes.

Mr. Teets, I look forward to the hearing your testimony.

[Following Secretary Teets' testimony]

Thank you, Mr. Teets. As always, your testimony is very insightful. At this point, we will proceed to questions.

[Proceed with Q&A]

Thank you for taking the time to be with us today. Our discussions have been very helpful

I would like to reintroduce the second panel. This panel includes representatives from industry, military academia, and civilian academia. As such, they will provide their perspective on the development of space professionals for the purposes of military space.

Each of the panel members will give a short oral statement, and then we will begin the question and answer period. The members of this panel include:

- Dr. Robert Calico, Provost of the Engineering and Management Department, Air Force Institute of Technology
- Captain Dan Bursch, USN. Associate Dean of the Graduate School of Engineering and Applied Sciences, Naval Postgraduate School.
- Mr. John Douglas, President and CEO, Aerospace Industries Association.
- Dr. Pam Shockley-Zalabak, Chancellor, University of Colorado at Colorado Springs
- And Dr. Victoria Coverstone, Professor of Aerospace, University of Illinois

Dr. Calico, please begin your short statement, and then we will just continue down the line.

[Each panel member will give a short opening statement]

Thank you for your statements. We will now begin questions.

[Q&A]

Thank you all for taking the time to be with us today. Your statements and comments will be very helpful as we consider the development of this important area for space and national security.

The hearing stands adjourned.

**Opening Statement
Honorable Silvestre Reyes
Ranking Member, Strategic Forces Subcommittee
Hearing on the Development of a Space Cadre**

Thank you Mr. Chairman for holding this important hearing, and I welcome all of our distinguished witnesses.

When the Space Commission assessed national security space management and organization in January 2001, they wisely recognized that organizational charts and management theories aren't worth much if you do not have quality people. And frankly, they recognized that the Department of Defense was not focused in any coherent way on developing personnel who would be knowledgeable about the national security uses of space. So, one of their main recommendations was to create a space cadre.

The American Heritage Dictionary defines cadre as follows:

“A nucleus of trained personnel around which a larger organization can be built and trained.”

The Space Commission used the word “cadre” deliberately. It recognized that none of the services was training a critical

nucleus of expertise in space matters, and that national security was sure to suffer without such expertise.

Acting on the Space Commission recommendation, Secretary of Defense Rumsfeld in October 2001 issued a memorandum directing the military services to draft specific guidelines and plans for developing, maintaining, and managing a cadre of space-qualified professionals. While the Air Force is directed to coordinate efforts among the services, each service is responsible for establishing its own space cadre. We have asked our witnesses from the Department to tell us how we are progressing, and honestly, I think many of us are going to be disappointed in what we hear today.

One question that I would like our department witnesses to address is: If space is critical to our national security, do we need joint management? Is this something that we should let the services do on their own, which so far has resulted in uneven progress across the department, or should we look at establishing a joint operation to achieve these goals?

I do not know the answer to that question, but I would like to hear our witnesses from the department address it.

Mr. Chairman, I also appreciate the fact that you have asked experts from industry and academia to join us on a second panel. We need to develop a nucleus of trained space experts not just in our military, but in our aero-space industry and academia as well. I think the subcommittee is correctly viewing the issue of space cadre broadly, and I look forward to the testimony of both panels.

Mr. Chairman, I yield back the balance of my time.

DEPARTMENT OF THE AIR FORCE

**PRESENTATION TO THE HOUSE COMMITTEE ON ARMED SERVICES
STRATEGIC FORCES SUBCOMMITTEE
UNITED STATES HOUSE OF REPRESENTATIVES**

SUBJECT: SPACE CADRE

**STATEMENT OF: MR. PETER TEETS
UNDER SECRETARY OF THE AIR FORCE**

22 July 2004

**NOT FOR PUBLICATION UNTIL RELEASED
BY THE COMMITTEE ON ARMED SERVICES
UNITED STATES HOUSE OF REPRESENTATIVES**

**Congressional Hearing Testimony
for the
Under Secretary of the Air Force
The Honorable Peter Teets**

INTRODUCTION

Mr. Chairman and members of the Committee, I am honored to appear before you today to address our current and planned efforts to develop our professional space cadre. I am also pleased to be joined today by General Lance Lord, Commander, Air Force Space Command (AFSPC); Vice Admiral James D. McArthur, Commander, Naval Network Warfare Command; Lieutenant General Larry J. Dodgen, Commanding General, Army Space and Missile Defense Command and Army Forces Strategic Command; and Brigadier General John R. Thomas, Director for Command, Control, Communications, and Computers, and Chief Information Officer for the Marine Corps.

In my testimony to the House Armed services Committee on February 25, 2004, I concentrated my remarks on the five National Security Space priorities I set for 2004. The priority of “developing and maintaining a team of space professionals” is and will remain a key element in accomplishing all the other priorities: achieving mission success in operations and acquisition; integrating space capabilities for national intelligence and warfighting; producing innovative solutions for the most challenging national security problems; and ensuring freedom of action in space. Today I will focus on our progress in developing the most crucial element of space power—our space professionals.

In my role of overseeing National Security Space activities as Under Secretary of the Air Force, Director of the National Reconnaissance Office (NRO), and the DoD Executive Agent for Space, I am committed to preserving our advantage as the world’s leading spacefaring nation. I

am pleased that this Committee shares that commitment, and that we all recognize the need to develop well-educated, motivated, and competent people who are skilled in the demands of the space medium.

THE DOD STRATEGY

The DoD has implemented many of the recommendations concerning the space cadre from the congressionally-directed Commission to Assess National Security Space Management and Organization, and we are working hard to develop the space cadre the nation needs.

Along with the Congress, the Department of Defense recognized the need to develop a professional space cadre across the entire National Security Space community. To meet that need, we prepared and are now implementing a Space Human Capital Resources Strategy for the DoD. With this strategy, we set the over-arching direction for the comprehensive professional development of officers, enlisted personnel, and government civilians into a total National Security Space team. We crafted the strategy carefully to acknowledge service and agency-unique structures and processes, and to use them as a foundation to build the broader cadre. We are working diligently to ensure the department has people with the necessary education, skills and experience, at all levels, both to develop space power and, more importantly, to bring space power to bear to meet warfighting, intelligence, and other National Security needs.

The Space Human Capital Resources Strategy has four main goals. The first is to ensure the services develop the basic building blocks—the space professionals they need to fulfill their service unique requirements. Much like our approach to developing aviators, our strategy for developing space professionals recognizes that the services have a wide variety of needs; one size truly does not fit all.

Under the second goal of the strategy, we are working to synchronize and integrate the space professional development efforts of the National Security Space community, with the aim of increased efficiency and reduced redundancies. With the establishment of a DoD Executive Agent for Space it became clear that some level of overarching management of our space professionals is necessary to provide unity of effort and strategic focus, and to guide the community in common endeavors. To this end we are establishing a DoD-level education and training framework, and will ensure that the services provide their requirements concerning the space cadre and the data needed to manage our space professionals.

We are continuing our diligent pursuit of the third goal of the strategy: to improve the integration of space capabilities into joint warfighting and intelligence operations. We are not developing space professionals to work in isolation. Our space professionals must understand the needs of the many and varied end-users of space capabilities, and be able to formulate and articulate new space doctrine to fully control and exploit the medium of space in support of our nation's security objectives. The depth and breadth of our space professionals' education, training, and experience must include an understanding of joint warfare and how space capabilities are best integrated into our concepts, war plans, and operations. Additionally, we must continue to educate our non-space professionals on what space brings to the fight. In order to do this the strategy requires increasing space education in our service and joint professional military education.

Professional education is not enough, however; we want to build a team of space cadre members who clearly understand the tactical and operational needs of the other media, as well as the unique tactics, techniques, and procedures involved in space operations. Cadre members must also be knowledgeable about space systems acquisition, the requirements of vehicles that

operate in space, and space-related research and development. We recognize that we need to send more acquisitions experts to the field where they can actually use the systems they produce, and bring more space and missile operators to program offices to apply their operational experience to the acquisition process. Working together across the services and agencies, we can identify and apply best practices within the entire National Security Space community.

The last goal of the strategy is to consistently assign the best space professionals to critical jobs across the DoD. We are examining many models as we decide how best to manage people at the DoD-level. We may emulate the three-tiered certification process under which acquisition professionals operate, or we may adapt the methodology we use to select personnel for joint-critical billets. Taken as a whole, these managerial tools will allow us to shape our team of space professionals and deliver the right person to the right place at the right time. This requires effort and forethought; our goal will be to create a system that serves the community without becoming onerous or self-defeating.

We believe that an integrated, strategic approach will help us develop the cadre we need. We are working within the framework of our strategy to improve coordination among the services, and I think we have struck the right balance by recognizing the services' unique missions and making allowance for service-unique solutions. We are committed to defining, training, and certifying space professionals in a consistent manner across the services, to build a total DoD space cadre that will meet the needs of our national decision makers and our Joint and Coalition fighting forces.

At this point, I would like to discuss how the NRO fits into this concept. The NRO is a remarkable team that benefits not only from its military elements but also from the marvelous technical and operational expertise of its Central Intelligence Agency members. I believe the

nation is best served by retaining the NRO's multi-service, multi-agency identity and its unique personnel prerogatives so that the NRO can continue to focus primarily on national intelligence needs. Within that construct, we are committed to treating the NRO as part of the larger space community. To that end, AFSPC and the NRO are crafting a Memorandum of Agreement that enables them to share personnel information with each other; establishes common administrative processes for such things as assignments and command selection; and ensures healthy crossflow of personnel. We are also reviewing the number of controlled Air Force assignments at the NRO, and expect to extend that review to the smaller number of Navy, Army, and Marine billets as well. Our goal is to capitalize on the broad experiences and opportunities available across the entire National Security Space team, to expand the space talent pool and serve the needs of the NRO and all of its mission partners.

PROGRESS TO DATE

We have made a great deal of progress toward the goals of the Space Human Capital Resources Strategy.

The Secretary of the Air Force approved the Air Force's Space Professional Strategy in July 2003. The strategy is being implemented and has resulted in many positive steps under the outstanding leadership of General Lance Lord, from whom you will hear in a few minutes.

The Navy has also created a sound Navy space policy document, which clearly defines their focal point for space cadre development. Vice Admiral Jim McArthur has assumed responsibility for the Navy space cadre, and will give you his insights as well.

The Army has initiated a space cadre force management analysis, which will define the Army Space Cadre and identify all space related roles, missions, organizational elements,

functions, and skills. This analysis will also include a review of Army doctrine, organizations, training, materiel, leadership and education, personnel, and facilities. Lieutenant General Larry Dodgen has been instrumental in the Army's space cadre development.

The Marine Corps has also established a focal point for space cadre management, and has in place a very mature process for developing space professionals. You will be pleased with what Brigadier General John Thomas has to say in this respect.

In collaboration with the DoD effort, the NRO is developing a workforce management strategy that will be aligned with the NRO Strategic Plan, the technical "Way Ahead," and the DoD space cadre development programs. The NRO is working hard to improve communication with its parent agencies regarding personnel requirements, and to create training and development programs tailored to the NRO's unique situation.

With respect to developing space cadre members, I continue to oversee development of the complementary space-related graduate degrees at the Naval Postgraduate School and the Air Force Institute of Technology (AFIT). I am very pleased with the work the Joint Space Oversight Board did in creating this program, and believe it marks substantial progress toward establishing the space cadre as well as an underlying culture for supremacy in space.

We are also pursuing initiatives to involve industry in our space cadre development. We expect great things from a new effort under AFIT's highly successful Education With Industry (EWI) program: the Lieutenant General Forrest S. McCartney Spacelift Education and Crossover Program, which is scheduled to begin with the 2004-05 EWI class. Also known as "Spacelift EWI," this program will select four officers a year (two space operators and two acquisition or engineering officers) and immerse them in today's space launch business. They will receive military developmental education through the AFIT-sponsored program and upon

completion receive a follow-on assignment targeted at spacelift operations. The program will provide experienced Air Force leaders for current launch systems such as the Evolved Expendable Launch Vehicle and next generation launch systems such as Operationally Responsive Spacelift.

These strong space education and training programs will provide the foundation for another key part of the strategy: professional certification for space cadre members. Professional certification will guide personnel from a foundation of technical competency, through demonstrated depth of knowledge, to extensive knowledge in space and warfighting operations. Space professional certifications will eventually form an integral part of the assignment process in that competitive command and staff billets will be identified with the certification levels required to fill them.

One of the goals of our training and certification efforts is to promote greater crossflow from acquisitions to operations and vice versa. Building the complete space cadre will require people who are willing—and able—to move from the system program office (SPO) to the operations squadron, to the laboratory, back to the SPO or to the NRO, to the headquarters, and so forth. Certification will serve as glue to hold the space cadre together as well as a long-term roadmap and mentoring guide to help us steer the right people into the right opportunities.

Lastly, I would like to share with you a few of the many near term activities we are working on. First, we are holding a space professional development conference that we will use to create our education and training framework to guide and manage our efforts. We are creating a detailed implementation plan for the Human Capital Resources Strategy which we will provide to the Armed services committees not later than November 15. This does not mean we are not already implementing it; instead, we want to ensure that specific goals, metrics, and schedule are

captured. Also, we have initiated a department wide data call to ascertain the demographics, trends and requirements of the space cadre.

CHALLENGES

Our DoD space cadre is doing a great job today, but we need to keep pushing forward if we want to sustain the United States as a world leader in space. I would like to take a moment to discuss two of the challenges confronting our space cadre.

First is a shortfall in systems engineering expertise. This shortfall was identified by the Defense Science Board/Air Force Science Advisory Board joint task force (the Young Panel), and is evident to anyone who has observed the state of the U.S. air and space industries. The Young Panel tracked the decline of expertise through the 1990s and noted that it led to decreased ability to lead and manage space acquisitions. To strengthen the systems engineering knowledge of our program managers, we have focused efforts on professional development, including additional training and the identification of best practices, at both the Space and Missile Systems Center and the NRO to rebuild this critical core competency. I list this challenge here because it is one area where our space professional development efforts should provide some relief: by giving acquirers operational or laboratory experience, they can apply deeper insight into sound engineering practices and make appropriate risk management decisions. I believe this will help them meet the extraordinary acquisition challenges posed by military space programs.

Another challenge facing us is to ensure that our space cadre—in each service—is given the optimum opportunities for professional development, career progression, and promotion. We recognize that right now our personnel are divided into the three core disciplines of operations, system acquisition, and space support, by virtue of what functions they perform. But we are

determined to ensure that such administrative divisions do not become “stovepipes” that stifle development and kill careers.

CONCLUSION

Operation IRAQI FREEDOM confirmed how important American dominance of space is to the successful conduct of military operations. A major pillar of this dominance has been the asymmetric advantages provided by our space systems that help our servicemen and women to fight and win. Developing, acquiring, deploying, and operating those space systems is the special purview of our space cadre.

Space programs are uniquely challenging to develop and sustain, because of the highly advanced technologies, severe operating environment, and inability to repair them on-orbit. This requires up-front investment and attention to detail that are greater than many other acquisitions and operations. As long as we need our space systems to provide extremely asymmetric advantages, even after years on-orbit, we will have to build systems on the leading edge of technology. We spend a lot of time working to minimize the risk and avoid surprises, but they are part of working on the thin edge of the future.

Even if we overcome the technical challenges that confront us, every technological capability in the world will prove useless unless we have the leadership, vision, motivation, and skills to employ those capabilities effectively. We cannot produce these qualities overnight. It will take time to nurture and develop this space cadre and allow it to mature. We do not know where the future will take this effort but we can be sure of one thing: in order to preserve our advantage as the leading space faring nation, individuals of exceptional dedication and ability will continue to be the backbone of our joint and interagency space operations.

I appreciate the continued support the Congress and this Committee provide to deliver these vital capabilities to our warfighters and National decision makers. I look forward to working with you as we define and refine the requirements for our space cadre: dedicated professionals with the depth and breadth of training, education, experience and vision to advance the use of space power and to transform military and intelligence operations.

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STATEMENT OF

GENERAL LANCE W. LORD

COMMANDER, AIR FORCE SPACE COMMAND

BEFORE THE

HOUSE ARMED SERVICES COMMITTEE

STRATEGIC FORCES SUBCOMMITTEE

UNITED STATES HOUSE OF REPRESENTATIVES

ON

JULY 22, 2004

NOT FOR PUBLICATION
UNTIL RELEASED BY THE
HOUSE ARMED SERVICES
COMMITTEE STRATEGIC
SUBCOMMITTEE

Introduction

Mr. Chairman, Congressman Reyes, and the distinguished members of the Committee, it is my distinct honor and privilege to appear before you today and represent the 39,700 space and missile professionals in Air Force Space Command. I am pleased to be joined by the Under Secretary of the Air Force, Mr. Peter Teets, Lieutenant General Larry J. Dodgen, Commanding General, Army Space and Missile Defense Command and Army Forces Strategic Command, Vice Admiral James D. McArthur, Commander, Naval Network Warfare Command and Brigadier General John R. Thomas, Director for Command, Control, Communications, and Computers, and Chief Information Officer for the Marine Corps.

I would like to extend my sincere gratitude to Congressman Everett and all the members of this committee for your continued support of military space and the development of our nation's space professionals. The commitment and dedication of this committee provides enormous resources and support to our space and missile professionals in the field.

As you know, the Secretary of the Air Force along with our Chief of Staff of the Air Force, General John J. Jumper and our Under Secretary, Mr. Peter Teets have made "Developing and Maintaining Our Space Professionals" a top priority for our nation. Our people remain our most important and precious resource. Personnel knowledgeable on the medium of space and highly skilled in their respective fields of operations, developmental engineering, acquisition and research are indispensable to our success today. The dedicated space professionals I have the privilege to serve with are some of the best men and women this nation has to offer. The future of military

space is bright and we need to make sure we give the next generation the proper development to become the space experts for the future.

I will concentrate my comments this afternoon on developing our space professionals, and in particular, share with you our progress to date. The Air Force is making great strides in implementing significant portions of the Space Professional Strategy. The Government Accounting Office in their June 2004 report validated our recent successes in this area. I am very excited at the progress we have made. This is a great example of the robust partnership we have with other organizations throughout the Department of Defense. The Air Force, as the Executive Agent for Space for the Department of Defense is proud to lead the Space Professional Development team.

Our Space Professional Development program and strategy consists of six major steps: Clearly identify Space Cadre members and track their experience, Develop a continuum of core education programs for our Space Cadre, Develop a three-tier Space Cadre Certification Program, Identify the appropriate Certification Level and experience for all billets (Department of Defense and National Reconnaissance Office), Develop Career Planning Guidance, and establish a permanent Space Professional Management Office. I am delighted to report we are clearly making significant progress across all six areas.

Identify the Space Cadre and Track Experience

Over 99% of our Air Force active duty Space Cadre members have been identified, entered into our database, and their experience in space operations, engineering, program management or scientific research has been documented. We knew identifying all our members and recording their experience would be a difficult

task. However, the results generated have exceeded our expectations. We did not fully realize the potential uses of this critical data. We are ready to move into the next phase of our Space Cadre development.

Identifying and recording the experience of each individual in our Space Cadre is a revolutionary step forward in tracking and assigning our space professionals. The detailed information in this database is extremely useful for our Force Development Teams. It allows the development team to quickly match critical skill sets and experience with the needs of the space community. The information gained from our database, when combined with the right leadership and mentorship, can quickly provide any combination of skill sets needed for any opening we need to fill. This capability to track the space experience of our personnel with greater precision is very similar to how the rated community in the Air Force tracks "flying hours" by aircraft.

We have initiated a similar process using the same methodology to identify and document the approximately 3,000 additional members of the Space Cadre serving as Air National Guardsmen, Air Force Reservists or civilians. We hope to gather and assess this information in the very near future. We are very proud of our Total Force approach in establishing our Space Cadre expertise. This is truly important to us, and incredibly important to our nation, to have continued development of all our space professionals in the Air National Guard and the Air Force Reserve.

Develop a Continuum of Space Education Courses

We started our Space 200 Education Course in July, 2003, and it has been offered seven times to over 200 students to date. This course is reserved for space professionals with eight to ten years of experience in their space related careers. I am

extremely proud to report the classes have included students from the Army, Navy, Air Force, Marines and NASA. We plan to increase the class attendance in the coming year to maximize this educational opportunity for the good of our nation's space professionals. We are also working to build entry-level educational opportunities like our Space 100 course. We estimate we will be able to educate over 400 students per year starting in the very near future.

We have also developed Advanced Space Training courses, which provide in-depth education on specific space missions. The first class graduated from our Navigation Operations course in June, 2004. Our plan is to offer Advanced Space Training courses in Missile Warning, Space Control, Nuclear Operations, Intelligence-Surveillance-Reconnaissance, Satellite Communications and Spacelift. Currently, we have consolidated the majority of our Space Education Courses into our existing Space Operations School in Colorado Springs, Colorado. Our vision is to evolve the Space Operations School into the center of excellence for space professional development across all organizations, with the help of our partners in the Department of Defense and the Intelligence Community.

Develop a Three-Tiered Space Cadre Certification Program

We recently completed the task of identifying over 7,000 Air Force active duty members (officers and enlisted) and entering their detailed experience codes into our database. This initial group of Space Cadre members have been evaluated, categorized and identified with the appropriate certification level. I led our senior leadership team at Air Force Space Command in approving the criteria for each certification tier earlier this year. We have instituted the certification process and we

continue to work diligently to document and record the levels of experience of our professionals.

Identify Prerequisite Experience and Certification for All Space Billets

Another outstanding example of our progress in developing our space professionals is how we have identified the necessary experience and certification for a substantial number of our space billets. More than 6,000 Air Force space billets have been tentatively coded with prerequisite experience and certification standards that will be necessary for an individual to qualify for a particular position. This initial assessment will be validated by the owning organizations and will be accomplished in the very near future.

Develop Career Planning Guidance and Issue Assignment Policies

As the Space Professional Functional Authority, I have provided guidance to the appropriate Force Development Teams at each regular meeting. We are in the process of developing a Space Career Planning Guide for our supervisors and members of the Space Cadre. This guide is designed to help individuals map out their career goals and aspirations. This document will be completed by the end of this year. The Career Planning Guide will be submitted to Congress by the February 15, 2005 deadline, by direction from the Senate Armed Services Committee.

Establish a Permanent Space Professional Management Office

We formed an initial Task Force in October of 2002 to kick off our Space Professional Development program. We owe a tremendous amount of gratitude to the Space Professional Development Task Force, for they were instrumental in initiating the planning for the development of our Space Cadre. Many of the initiatives we have

instituted will require long-term oversight. Therefore, Air Force Space Command formally established a permanent Space Professional Management Office under our Mission Support Directorate on July 1, 2004. We are dedicated to investing the necessary resources in both manpower and funding to ensure we properly manage the development of our space professionals.

Conclusion

We have made tremendous strides in developing our space professionals not just in Air Force Space Command, but also throughout the United States Air Force. Our people remain our number one priority, and we are unable to accomplish our mission without adequate education and development of our most precious resource. Our senior leaders in the Department of Defense and in the Air Force clearly understand the commitment this requires. The Space Professional Development program is on track and providing outstanding results. We still have some hard work ahead of us, but our dedication and energy is well focused on this vital program.

As always, I am honored to appear here before this distinguished committee. Today, our nation relies more on capabilities coming from and in space, than ever before. I understand the significance of developing our space professionals and rest assured we are dedicated to this cause. Our nation cannot rest on the asymmetric advantage we have today in space. We must move out and "Command Our Future" to make sure we continue to provide the world's greatest space capabilities to our joint forces for the foreseeable future. We are committed to developing our space professionals and I am proud to represent the Air Force here today.

RECORD VERSION

STATEMENT BY

LIEUTENANT GENERAL LARRY J. DODGEN, USA
COMMANDING GENERAL,
U.S. ARMY SPACE AND MISSILE DEFENSE COMMAND
AND
U.S. ARMY FORCES STRATEGIC COMMAND

BEFORE THE

COMMITTEE ON ARMED SERVICES
STRATEGIC FORCES SUBCOMMITTEE
UNITED STATES HOUSE OF REPRESENTATIVES

SECOND SESSION, 108TH CONGRESS

JULY 22, 2004

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Lieutenant General Larry J. Dodgen
Commanding General
U.S. Army Space and Missile Defense Command/U.S. Army
Forces Strategic Command

Lieutenant General Larry J. Dodgen assumed command of the U.S. Army Space and Missile Defense Command / U.S. Army Forces Strategic Command (USASMDC/ARSTRAT) on December 16, 2003.



Born in New Orleans, La., General Dodgen graduated from Louisiana State University in 1972 with a bachelor's degree in Chemical Engineering. He also holds an MBA in Public Administration from the University of Missouri and a master's degree in National Security and Strategy from the United States Naval War College. His military education includes the Air Defense Officer Basic and Advanced Courses, the U.S. Army Command and General Staff College, and the U.S. Naval War College.

General Dodgen began his military career as Section Leader and later Platoon Leader, Battery A, 1st Battalion, 68th Air Defense Artillery, 1st Cavalry Division, Fort Hood, Texas. In 1975, he was assigned as a Firing Platoon Leader, 2d Battalion, 71st Air Defense Artillery, Eighth United States Army in Korea. While in Korea, he became the Aide-de-Camp to the Commanding General, 38th Air Defense Artillery. After returning to the United States, he served as Aide-de-Camp to the Assistant Commandant, U.S. Army Air Defense Artillery School, Fort Bliss, Texas. He later commanded Battery C, 1st Battalion, 7th Air Defense Artillery, Fort Bliss, Texas. In 1981 and 1982, General Dodgen commanded Battery A and served as the Assistant S-3 (Operations), 3d Battalion, 61st Air Defense Artillery, 3d Armored Division in Germany. In 1984, he was assigned to the U.S. Army Chemical School, Fort McClellan, Ala., as an NBC Analyst and later became Chief of the Studies Branch. In 1987, he became the Executive Officer, 6th Battalion, 43d Air Defense Artillery, in Germany. From June 1989 to December 1991, he commanded 8th Battalion, 43d Air Defense Artillery, and led his battalion into combat in Saudi Arabia during OPERATION DESERT STORM. In 1993, he returned to Germany to command the 69th Air Defense Artillery Brigade. While in Germany, he also became the Chief of the CINC's Initiatives Group, Office of the Command-in-Chief, U.S. Army Europe. After assuming the rank of Brigadier General in 1996, he became the sixth Deputy Assistant Secretary of Defense for Policy and Missions. From May 1998 to September 2001, he was the Director, Joint Theater Air and Missile Defense Organization (JTAMDO). From September 2001 to December 2003, he was the Commanding General of the U.S. Army Aviation and Missile Command (AMCOM).

General Dodgen's military decorations and awards include the Defense Distinguished Service Medal with Oak Leaf Cluster, Legion of Merit (two Oak Leaf Clusters), Meritorious Service Medal (four Oak Leaf Clusters), Army Commendation Medal, and the Army Achievement Medal.

**Lieutenant General Larry J. Dodgen, USA
Commanding General
U.S. Army Space And Missile Defense Command
And
U.S. Army Forces Strategic Command**

Introduction

Mr. Chairman, Rep. Reyes and Members of the Committee, thank you for the opportunity to appear before this distinguished committee and for your ongoing support of our Army. This panel continues to be a friend of the Army, particularly of our efforts in space. The Army considers it a privilege to be counted in the ranks with Mr. Teets, General Lord, Vice Admiral McArthur and Brigadier General Thomas as joint advocates of a well-trained space cadre. Today, I appear before this committee as the Army proponent for space.

As you know, in 2001, the Commission to Assess United States National Security Space Management and Organization, commonly referred to as the Space Commission, unanimously concluded that the security and well being of the United States, its allies and friends depended on the nation's ability to operate in space. The Army previously recognized the need for a cadre of space professionals specifically trained in, and knowledgeable about, space capabilities to complement the actions of the signal, intelligence, information operations, and engineering staff personnel working within the space arena. Accordingly, in 1998, the Army established Functional Area (FA) 40 - Space Operations. The United States Army Space and Missile Defense Command (USASMDC) is the Army's specified proponent for space and the personnel proponent for all FA 40 officers. The current Army Space Cadre also includes branch and other

functional area officers who hold the Skill Identifier 3Y-Space Activities and Skill Identifier 3E – Tactical Exploitation of National Capabilities (TENCAP).

These diversified skills utilized in space missions are evidenced in the Army Space Support Teams. These teams use soldiers with military occupational skills in intelligence, signal, and engineering to collectively produce space based information and products for integration into command war plans and operations. Their utility has been demonstrated in Operation Enduring Freedom and Operation Iraqi Freedom. The lessons learned from these deployments will contribute significantly to defining and developing a comprehensive Army Space Cadre Strategy.

While the Army has already designated these core members of the Space Cadre, the Army recognizes its space professional cadre also comprises soldiers and civilians from a wide variety of other branches, career fields, disciplines and functional areas. Officers, warrant officers, enlisted and civilians from across the Army constitute a population of space-smart professionals who predominately work space-related issues and requirements. Other Army space professionals include scientists, engineers, and acquisition personnel skilled in research, space system development, acquisition, and the application of emerging technologies to support the Army's needs and joint full spectrum operations. They are competent and skilled in all aspects of developing, procuring, employing and advising the warfighter on maximizing the use of Army and Joint space systems to support full spectrum operations.

Space Formal Process

In order to comply with Department of Defense direction and General Accounting Office recommendations, the Army has decided to use the Force Management and

Analysis Review (FORMAL) process to establish and maintain a professional space cadre. The FORMAL process was selected for several reasons. First, as the capstone force management tool, the FORMAL review provides intensive management forums to facilitate Army-wide integration of all activities required to produce and sustain mission capable units to perform Army missions. Second, the FORMAL allows senior Army leaders to resolve issues affecting execution of programs and initiatives within the Space Cadre. Finally, it provides a valuable forum for horizontal and vertical integration within the Army.

The FORMAL review process focuses on the Army's ability to maintain the readiness and the force capability required to support combatant commanders. Simultaneously, the review process allows continuous training and modernization of the Space Cadre. As such, the FORMAL process involves the entire Army force structure.

To facilitate the process, the Army designated USASMDC to conduct the Army Space Cadre FORMAL (ASCF). The scope of the ASCF is to define the Army cadre of space professionals, establish professional military space education that emphasizes combat operations, and maintain a sufficient Space Cadre. This Cadre will have the ability to develop, plan, program, and acquire space systems uniquely required to support the Army's missions.

The Army Space Cadre FORMAL comprises four phases:

- Phase I will establish an Army-unique definition for the Army Space Cadre for use in the remaining three phases.

- Phase II is an analysis of the Army force structure to identify space cadre roles, missions, organizations, functions and personnel based on the Phase I Space Cadre definition.
- Phase III consists of a review of Department of the Army policies supporting the Army Space Cadre within the eight life cycle functions (structure, acquisition, individual training and education, distribution, deployment, sustainment, professional development, and separation).
- Phase IV is a comprehensive analysis of the doctrine, organization, training, materiel, leadership & education, personnel, and facilities (DOTMLPF) domains needed to develop the Army Space Cadre end-state strategy.

At the present time the Army is engaged in the Phase I process of developing our unique definition of Space Cadre.

As we move forward, the Army will profit from the efficiencies gained as a result of the FORMAL. An Army Space Cadre that provides significant value will result from this review. The review also fulfills Congressional mandate, implements Department of Defense directive, and meets guidance from the Department of Defense Executive Agent for Space. Most importantly, a core of highly trained professionals will be identified and tracked to fully support our Nation's Warfighters. This process will also increase the Army's capability to support Combatant Commanders. Finally, the process will result in the establishment of a centralized Army Space Cadre Management Office, which will be responsible for the implementation of the Army's strategy.

Education and Training

Education and Training are critical for the success of the Army Space Cadre. Accordingly, five years ago, the Army developed a space qualification course and established the Army's Space Operations Officer (FA40) Qualification Course (SOOQC) in 2001.

I would like to report that the sixth iteration of SOOQC is currently in session and will graduate on 27 August 2004. These graduates are exposed to a variety of areas of training designed to provide them the skills required to plan and conduct space operations. Skills such as planning space control operations, analyzing friendly force space control capabilities and limitations, recommending space applications to support the military decision-making process, and determining the impact of space and weather on space and terrestrial operations. After the current class graduates from SOOQC, they will attend an enhanced course that will provide increased technical space training in key mission areas. They will receive in-depth training in space-based blue force tracking, space control, and space analytical software applications. The SOOQC and enhanced training will provide the educational foundation for a relevant and ready professional space cadre.

The Army is also actively participating in the training, development and execution of new joint courses that will be offered by the US Air Force Space Operations School (SOPSC). These joint courses include:

- A 1-week fundamentals Space Support Course that targets new space operators.
- A 4-week Space 200 course designed for mid-career students with some space background. This course is now used as the foundation for SOOQC.

- A future Space 300 series that will provide senior space operators with a strategic-level focus of space operations.
- The development of a 12-week mission area specific Advanced Space Training (AST) series of courses. ASTs will produce technically proficient weapons officers that will work hand-in-hand with operational counterparts in the mission areas of navigation warfare, missile warning, and space control.

In addition to the SOOQC and other space specific training, members of the Space Cadre will continue to receive relevant instruction on newly emerging space developments. Lessons learned from ongoing joint world-wide operations, joint exercises and emerging technologies will influence future training of our space cadre.

Some space operations officers will attend formal academic training. A Master of Science Space Operations or Engineering curricula is offered at the Naval Postgraduate School and the Air Force Institute of Technology. There are also Training- with-Industry opportunities, USAF Air Education & Training Command (AETC) courses, and Space Warfare Center (SWC) SOPSC courses. Finally, two Memoranda of Agreement (MOA) were signed with Webster University and American Military University to grant SOOQC graduates 15 graduate credit hours to be applied to those universities MS Space curricula. As is evident, opportunities for our space professionals continue to expand.

Joint educational endeavors continue to evolve. For instance, the Army's partnership with the US Air Force and Navy will result in Army Space Operations officers eventually attending the National Security Space Institute (NSSI). The NSSI, a space education and training institute in Colorado Springs, Colorado, will capitalize on the synergy of a multi-service approach over the continuum of space education and

training venues that meet the future needs of DoD and service component space cadres. The Army is currently participating in developing operationally relevant new space operations courses and has established a physical presence at the USAF Space Operations School (SOPSC). The Army and SOPSC will soon conclude an MOA that further solidifies our partnership. The Army fully supports the migration to and synergistic consolidation of space education and training within the NSSI. We enthusiastically look to the NSSI future as the ultimate high ground training institute that will meet the education and training requirements of the Army's maturing space cadre.

Conclusion

Through these processes the Army will improve management of its space assets and develop systems to ensure proper education and career development for its space professionals. Mr. Chairman, the future of the Army's professional Space Cadre is an exciting one as it continues to evolve and grow. The Army's Space Cadre Strategy developed through the FORMAL process will articulate our long-term goals and be in full compliance with Congressional intent, DoD Executive Agent directives, and GAO recommendations. As we move forward with our sister services, the Army is certain that the Armed Forces will continue to remain at the forefront of space developments.

Thank you for the opportunity to appear before you today and for your attention to this important matter. I look forward to answering any questions you and the other members of the Committee may have.

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UNTIL RELEASED BY THE
HOUSE ARMED SERVICES
COMMITTEE STRATEGIC
SUBCOMMITTEE

STATEMENT OF

VICE ADMIRAL JAMES D. McARTHUR

COMMANDER, NAVAL NETWORK WARFARE COMMAND

**BEFORE THE
HOUSE ARMED SERVICES COMMITTEE
STRATEGIC FORCES SUBCOMMITTEE
UNITED STATES HOUSE OF REPRESENTATIVES**

ON

JULY 22, 2004

NOT FOR PUBLICATION
UNTIL RELEASED BY THE
HOUSE ARMED SERVICES
COMMITTEE STRATEGIC
SUBCOMMITTEE

Introduction. Chairman Everett, Congressman Reyes, and distinguished members of the Committee; it is my honor to present you with an overview of Navy's space cadre efforts and the manner in which this cadre supports our warfighting mission. I am Vice Admiral James McArthur, Commander of Naval Network Warfare Command, located in Norfolk, Virginia. Naval Network Warfare Command is the Navy Functional Component Commander to the Commander, U.S. Strategic Command, for space, information operations and network operations. I support and advise my Navy chain of command, Admiral Bill Fallon at Fleet Forces Command, on space operations, training, and requirements, in support of the Fleet.

My primary responsibility is to ensure that the Navy's daily operational requirements for networks, space, and information operations are met, and that the Navy networks, which support all warfighters and decision makers, are secure. Space is vital to that network, second only to the professional Sailors, Marines, Civilians and Contractors that make up our operational force. For this reason, I have assumed personal responsibility for leadership of the Navy Space Cadre.

To understand the role of our Navy Space Cadre, one must understand the importance of space to the Navy and our need to integrate space into every facet of maritime operations.

Navy and Space. Space assets provide access, perspective and persistence for joint communications, intelligence, surveillance and reconnaissance, precision navigation and timing, meteorology and oceanography, and missile warning. Space capabilities make possible the fundamental qualities – decisiveness, sustainability, responsiveness and agility – required in a winning Naval force. Without space, our ships would face great difficulty in operating beyond the horizon. Our Navy command and control capability is dependent on space – communications (voice, data) and imagery. Over ninety percent of our weather and

oceanographic information comes from space. Our electronic intelligence (ELINT) comes in large part from space. Much of our targeting comes from space. As you can see, Navy is critically and irrevocably tied to space. Space is an integral piece of Naval Power 21 that requires a highly integrated force, capable of working in a joint and coalition environment, and going it alone when necessary. Space must be fully integrated into all our operations to optimize the space assets today and in the future.

Integration is not a single-threaded process. It requires full participation in all facets of space – concepts and requirements development, research, development, acquisition, and operations. It means engaging and participating in those forums that influence policy; planning our next generation space systems; and exploiting our current systems. It means the teams that develop the next generation aircraft carrier must have space expertise so that intelligent use of space is built in from the start. It means that our Sailors must be space savvy, so that they can make the most of space capabilities, and help guide new means of exploiting space. In other words, successful application of space in the Navy translates to a healthy and robust Navy Space Cadre.

Much has been accomplished in building a space cadre across all the Services within the past few years. Working within Navy, coordinating with General Thomas and Lieutenant General Huly in the Marine Corps, General Lord, General Dodgen, and of course Mr. Teets, we have made great strides on all fronts. I am particularly proud of the direction we have established for the Navy Space Cadre, and our ability to leverage the larger Navy Human Capital

Strategy and the National Security Space Human Capital Resources Strategy orchestrated by Mr. Teets.

Navy Space Objectives. In accordance with its updated Department of Navy Space Policy, the Navy's objectives are to: *"(1) integrate the essential capabilities provided by space systems at every appropriate level throughout the Naval force; and (2) shape the outcome of joint deliberations on future space system capabilities to ensure the combat effectiveness of Naval forces."* To accomplish this, the Navy needs a space cadre with the right mix of operational and space expertise, which is why we have chosen to take an inclusive approach to our space cadre definition. This inclusive approach is critical in our ability to develop and manage the space cadre.

First and foremost, our objective is to ensure that our space cadre is an integral part of Navy's overall manpower strategy. We need to ensure we have the right skills and we identify the training and experience required to hone those skills. We need to put our cadre in the right places, where they provide the maximum benefit for Navy and the entire National Security Space community.

Navy Space Cadre today is a distinct body of expertise that is horizontally and vertically integrated within existing active duty and reserve Unrestricted and Restricted Line communities, and Department of Navy civilian employees organized to operationalize space. Navy does not have a separate career path for its space cadre, and as such, cadre members must remain competitive within their primary communities. To encourage upward mobility for our cadre

members, all officer promotion boards since Fiscal Year 2004 have included language about the importance of space to the Navy. This language has helped to improve our promotion and retention of space cadre members. There are 252 officer billets coded for space systems operations or space systems engineering, subspecialty codes 6206 and 5500 respectively. Today we have 670 active duty officers identified as space cadre members, and we are working to further define the reserves, enlisted and civilian members of our space cadre.

Navy has informally managed its space expertise since the early 1980's, when the first space graduates from Naval Postgraduate School returned to the Fleet. The acquisition corps of the space cadre has been actively mentored since the early 1990's, under the careful guidance of Rear Admiral Rand Fisher at the National Reconnaissance Office. In the past five years, the Navy's strategic placement of its space acquisition cadre has gone up significantly throughout the National Reconnaissance Office. This has substantially increased the Navy's insight into all National Security Space programs, providing our voice into the development and acquisition of these programs. The Navy has Flag representation on the National Reconnaissance Office Board of Directors, Directorship of the Communications and Acquisition Engineering Directorate, and Director of the Transformational Communications Office, as well as O-6's in Program Manager positions throughout each of the Directorates. Outside the National Reconnaissance Office, the Navy has been very successful in placing its space cadre in key positions at the National Security Space Office. To implement such focused management of the space cadre Navy-wide, a new position was established to report to key staffs within Navy headquarters, N13, Personnel Policy and Plans, and N61, Command, Control Communications. In September 2002, Captain Cheryl Spohnholtz, took the helm of our space cadre as the first Navy Space Cadre Advisor. The Space

Cadre Advisor Office will be funded in Fiscal Year 2005 and will initially be staffed with two Navy Commanders. One will be assigned to N13 in Washington DC to coordinate with the National Security Space Community. The other will be assigned in Millington, TN to work directly with the detailers. This approach will help ensure we assign our space qualified officers to the right places to best influence the outcome of critical National Security Space plans and policies. Navy Space Cadre members are also assigned to several Joint Program Offices, including Military Satellite Communications (MILSATCOM), Global Positioning Service (GPS), Global Broadcast System (GBS), and Space-Based RADAR (SBR), and U.S. Strategic Command, as well as in all Navy organizations that deal with space. On the waterfront, an initiative is underway to “space code” additional fleet billets, better reflecting the expertise required to maximize operational use of space capabilities.

Cadre Training and Development. Navy space education is conducted at the U.S. Naval Academy, Naval Postgraduate School, and Naval War College. The Naval Academy has a very strong astronautics track, graduating approximately 30 students per year. Recent graduates have been heavily involved in building, launching and operating small satellites. The Naval Postgraduate School’s space systems program has mirrored the evolution of space in support of military operations, and has provided graduate education to those officers and government civilians who represent the core professionals that manage the design, development, acquisition, operation and exploitation of our national space program. For over 20 years, Naval Postgraduate School has provided the highest levels of space systems technical education to military officers from each service, Navy, Air Force, Army, Marines, as well as Department of Defense civilians, providing masters and doctorate level education to an all-service student

population in support of National Security Space objectives. Additionally, to improve space education availability to our deployed forces, Naval Postgraduate School offers a Space Systems Certificate program, consisting of four distance learning courses. For more senior officers, Naval War College includes some basic space information in its core curriculum and offers a space elective course. As a result of a memorandum of agreement between the Secretaries of the Navy and Air Force in 2002, the Naval Postgraduate School and the Air Force Institute of Technology have developed an educational alliance. Mr. Teets established a Joint Space Oversight Board to oversee the space curricula at the two institutions and has encouraged multi-service participation at each of these schools.

Beyond our space education efforts, Navy has long taken advantage of training courses developed and taught by the Air Force, such as Joint Space Fundamentals. Today, we are coordinating with the Air Force on the Space Operations School National Security Space Institute curriculum development and have sent Navy students to several of the prototype courses to provide maritime perspective. The Navy Space Cadre Advisor is working closely with the other Service cadre managers to ensure these courses meet National Security Space objectives. Requirements for Fleet space training are being gathered, and for those requirements not met by the Space Operations School, Navy will develop specific maritime courses.

Our overall education and training strategy is multi-dimensional. This is necessary, as no single curriculum or format can meet the needs of the full cadre. By introducing the astronautics curriculum at the Naval Academy, we have an initial opportunity to entice new cadre members, and put some "space smarts" into the Fleet. The graduate level education allows us to increase and refine the skills base and further our expertise. Distance learning supports maintenance and

currency of expertise, as well as the ability to reach an audience that may not otherwise have an opportunity to attend Naval Postgraduate School. By coordinating with the other Services, leveraging one another's training programs, we are getting the most return on investment.

Conclusion. Integrating space so that our warfighters can truly have the information advantage is the objective of our space cadre. The future of the Navy is tied to space, and that is why we must succeed in shaping and maintaining our space cadre. We provide a key component to the National Security Space community with our continuous influx of operational experience. We will be robust, we will be well trained, and we will offer the necessary incentives to attract and retain the best and the brightest the Navy has to offer.

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SERVICES COMMITTEE

STATEMENT OF
BRIGADIER GENERAL JOHN R. THOMAS
DIRECTOR FOR COMMAND, CONTROL, COMMUNICATIONS, AND COMPUTERS
UNITED STATES MARINE CORPS
BEFORE THE
HOUSE ARMED SERVICES COMMITTEE
SUBCOMMITTEE ON STRATEGIC FORCES
CONCERNING
SPACE CADRE AND
SPACE PROFESSIONALS IN THE MILITARY
ON
JULY 22, 2004

NOT FOR PUBLICATION
UNTIL RELEASED BY
THE HOUSE ARMED
SERVICES COMMITTEE

Brigadier General**John R. Thomas**

Director for Command, Control, Communications, and Computers (C4),
and Chief Information Officer (CIO) for the Marine Corps



Brigadier General Thomas is the Director for Command, Control, Communications, and Computers (C4) for the United States Marine Corps, the Chief Information Officer (CIO) of the Marine Corps and Commander of the Marine Corps component to the Joint Task Force for Computer Network Operations.

Brigadier General Thomas was commissioned a second lieutenant in May 1973. He is a graduate of Appalachian State University with a Bachelor of Science Degree, Prairie View A&M University with a Master in Business Administration, and Naval War College with a Master of Science in National Security and Strategic Studies. His military schools include the Basic School, Advanced Communications Officer School, United States Marine Corps Command and Staff College, and the College of Naval Warfare.

His previous command assignments include:

- Commanding Officer, 1st Surveillance, Reconnaissance, and Intelligence Group, I Marine Expeditionary Force
- Commanding Officer, 7th Communications Battalion, III Marine Expeditionary Force
- Commanding Officer, Communications Company, 3d Force Service Support Group
- Platoon Commander

His previous staff assignments include:

- Deputy Director, Command, Control, Communications, and Computers HQMC
- Director, Programs Division, Programs and Resources Department HQMC
- Assistant Chief of Staff G-6, Marine Forces Pacific
- Assistant Chief of Staff G-6, First Marine Expeditionary Force
- Chief, Command Centers Support Division, Command, Control, Communications & Computers Directorate (J6), Joint Staff
- Communications Support Officer, National Military Command Center
- Program Coordinator, Space, Command and Control Directorate, Chief of Naval Operations
- Marine Officer Instructor, Prairie View A&M University

Brigadier General Thomas' awards include: Legion of Merit, Defense Superior Service Medal, Meritorious Service Medal with gold star, Navy and Marine Corps Commendation Medal with gold star, National Defense Service Medal with two bronze stars, and Humanitarian Service Medal

Chairman Everett, Congressman Reyes, distinguished members of the Committee; it is my honor to present you with an overview of the Marine Corps' space cadre efforts and a brief summary of the manner in which this cadre supports our warfighting mission. During the past year, the Marine Corps has made a significant effort to develop a space cadre consisting of Marines who are not only "space smart", but well grounded in our warrior ethos. The Marine Corps recognizes the significant contribution National Security Space makes to our warfighting mission as well as our national security and is pleased with the progress we have made in the development of our space cadre. We also appreciate the sustained interest and commitment of this committee to the continued development of our space forces and respective space cadres.

I. INTRODUCTION

From its inception, the Marine Corps has modeled itself as an expeditionary force. Marines have maintained this expeditionary ethos by focusing on our people, and acquiring systems that can function in an expeditionary environment, allowing us to maintain a high "tooth to tail" ratio. As such, we have and will continue to leverage the capabilities provided by National Security Space systems, relying on their unique attributes to support our forces at the furthest reaches of the globe. The Marine Corps has developed its space cadre around Marines who are first and foremost professionals in their military occupational specialty, but who are also well versed in the capabilities provided by National Security Space.

II. BACKGROUND

Title 10 of the United States Code dictates that the Marine Corps "*shall be organized, trained, and equipped to provide Fleet Marine Forces of combined arms, together with supporting air components, for service with the fleet in the seizure or defense of advanced naval bases and for the conduct of such land operations as may be essential to the prosecution of a naval campaign*". Further, DoD Directive tasks the Navy and Marine Corps "*to organize, train, equip, and provide Navy and Marine Corps forces for the conduct of prompt and sustained combat incident to operations at sea, including operations of sea-based aircraft and land-based naval air components... and to conduct such land, air, and space operations as may be essential to the prosecution of a naval campaign*".

Accordingly, the Marine Corps organizes to fight as a Marine Air-Ground Task Force, or MAGTF. The MAGTF is a combined arms force that brings together aviation, ground forces, combat service support, and a command element to execute missions. Increasing the combat effectiveness and combat power of our MAGTFs requires us to continually evaluate our capabilities. In doing so, we need to ask ourselves “what is the next step?” and focus our effort on the enablers that will ensure that the Marine Corps maintains its expeditionary edge and culture. As a major user of space-based systems, the Marine Corps continues to integrate space-based capabilities into Marine Corps concepts of operation.

III. MARINE CORPS' SPACE CADRE – GOALS AND OBJECTIVES

The Marine Corps' focal point for the development and implementation of the Marine Corps Space Cadre is the Deputy Commandant for Plans, Policies, and Operations in his role as the Marine Corps' focal point for space planning, programming, and policy. He is assisted in the development of the space cadre by the Deputy Commandant for Manpower and Reserve Affairs, the Deputy Commandant for Combat Development, the Director of the Command Control, Communications, and Computers Department, and the Director of the Intelligence Department.

The Marine Corps' ability to fully leverage space-based capabilities and to integrate space operations in support of our core missions requires the creation of a Marine Corps cadre of space professionals capable of supporting MAGTF operations. We have established the following goals and strategic objectives for our cadre of space professionals:

Goals

The Marine Corps' goal is to produce and maintain a cadre of Marines (active duty, reserve, and civilian) with a diverse set of primary Military Occupational Specialties (including Ground, Aviation, Combat Support, and Command and Control) who are:

- Trained in joint space operations planning;
- Educated in National Security Space (NSS) activities; and
- Experienced in space requirements generation, concept development, planning, programming, acquisition, and/or operations.

This combination of NSS experience, when coupled with a firm grounding in Marine Corps doctrine and operational experience, ensures we will have “space smart MAGTF officers” capable of blending the unique attributes of space with the needs of our operational units.

Strategic Objectives

Additionally, the Marine Corps’ strategic objectives are:

- To support the vision and goals of Marine Corps Strategy 21 by creating a cadre of Marines who understand both the capabilities of a Marine Air-Ground Task Force and the unique advantages to be gained by fully exploiting current and future space-based systems.
- To increase the integration of current and future space-based capabilities into Marine Corps systems to support the Corps’ Expeditionary Maneuver Warfare capstone concept and to enable FORCENet and the transformational naval operational concepts of Sea Strike, Sea Basing and Sea Shield.
- To shape the development of future space systems to meet Marine Corps warfighting needs through increased collaboration with all National Security Space (NSS) partners.
- To increase the effectiveness of our operating forces through effective planning, integration and coordination of space-based capabilities and assigned space forces.
- To increase the distribution of Marines with space training and experience not only throughout the NSS community, but also more importantly throughout the operating forces to inject space-knowledge at the individual unit level.

IV. STATUS OF THE MARINE CORPS SPACE CADRE

In order to develop personnel with the requisite background in space and space systems, the Marine Corps has, for a number of years sent officers to the Naval Postgraduate School to undertake advanced education leading to a Master’s Degree in Space Systems Operations. Upon graduation these officers are assigned the Military Occupational Specialty “Space Operations Officer”. These officers comprise the nucleus of the Marine Corps space cadre, and they fill key

space billets within the Marine Corps and throughout the National Security Space arena. Currently there are 21 of these officers on active duty with an additional 6 students currently at the Naval Postgraduate School. These officers, upon completion of their degree program, are immediately ordered to a National Security Space billets. Following completion of this tour in a National Security Space billet, they will return to their primary MOS, which serves a dual purpose and is in keeping with our goal of developing "space smart MAGTF officers". First, these officers bring advanced education and space operations experience to the operating forces, thereby ensuring an infusion of space expertise in the MAGTF. Second, by returning to their primary MOS, these officers maintain their operational relevance, which keeps them current in Marine Corps doctrine and operations. Following this tour in their primary MOS, the officer may then return to a National Security Space billet, bringing a wealth of current operational experience to the NSS community. It is this experience that will ensure our investment in National Security Space supports the forward-deployed warfighter.

Our graduates from the Naval Postgraduate School undergo a rigorous 2-year technical curriculum that is neither required nor appropriate for all of our personnel serving in space related billets. Hence, last year the Marine Corps created a new skill designator Military Occupational Specialty, the Space Operations Staff Officer. The purpose of creating this skill designator was twofold:

- First, it serves to identify those officers with space education and experience. These officers are Marines who have attended an approved course in space operations and have served in a space-related billet for a minimum of 6 months. These officers make up the majority of our space cadre, and are the officers that provide space experience to the MAGTF. In a manner similar to our Space Operations Officers, these officers are experienced in both Marine Corps operations and space operations, and play a key role in integrating space capabilities into our doctrine and planning process. Since its inception in June of last year, the Marine Corps has awarded this MOS to 40 officers who possess the requisite skills and training.
- Second, the MOS serves to identify billets in which space operations training and experience are required. During the past year, the Marine Corps initiated a study to ascertain which existing billets required the addition of the Space Operations Staff Officer MOS and what new structure should be considered. The Marine Corps identified 62 billets within both the

Marine Corps and the National Security Space community that require the unique skill sets and training provided by Space Operations Staff Officers.

V. TRAINING AND EDUCATION

As mentioned previously, the Marine Corps' primary focal point for space education has and will continue to be the Naval Postgraduate School. The Naval Postgraduate School enjoys an outstanding reputation and has proven its ability to prepare our officers for challenging follow-on assignments in National Security Space. We have worked in concert with the Naval Postgraduate School to develop tailored curricula to support our officers, and feel that we have developed specific tracks that will not only better prepare our personnel for their follow on assignment, but also provides for meaningful research supporting the Marine Corps' objectives in National Security Space. The Naval Postgraduate School has been very receptive to our ideas and initiatives, and we have been very pleased with the education that our officers receive and the contribution they make to the Marine Corps operations and our efforts in National Security Space.

The Marine Corps is also working closely with the U. S. Army Space and Missile Defense Command, and Air Force Space Command to develop courses that will support the development of the Marine Corps space cadre. In support of this effort, the Marine Corps has assigned a reserve Marine officer to Air Force Space Command's Space Operations School, and has provided the school detailed educational skill requirements for the training of our Space Operations Staff Officers. The Space Operations School, in turn, is working to assess these requirements and recommend courses to support Marine Corps needs. Many Marines have completed space operations training courses, and during the past year, our Marines have attended both the Army's FA-40 Space Operations Officer Qualification Course as well as the Space Operations School Space 200 course. The Marine Corps plans to continue to send personnel to space training courses, not only to provide them with the space training they need, but just as importantly, to interact with personnel from our sister Services. This interaction in the classroom will help foster the understanding between the Services, ultimately leading to a more capable joint force. We look forward to continuing to work with the Space Operations School and the NSS community to develop relevant, rigorous joint courses that will meet the warfighters' needs.

Finally, we have worked at length to bring space education to all our Marines through our resident and non-resident professional military education (PME) programs. We have recently provided detailed course outlines and video instruction as part of our intermediate level school distance education program. This course of instruction reaches thousands of officers throughout the Marine Corps, presenting them with an overview of space capabilities, limitations, and planning considerations. Additionally, we have integrated space education into our resident PME courses, providing blocks of instruction that provide overviews of space capabilities as well as current lessons learned.

VI CONCLUSION

Looking to the future, the Marine Corps will continue to ensure that all levels of command understand the benefits of space-based capabilities, and increase the number of space trained personnel. Additionally, we will continue to evaluate the training, assignment, and status of our space cadre.

We are pleased with the significant progress we have made thus far in the development of our space cadre, and we firmly believe that the development of operationally relevant, space smart MAGTF officers will make a significant contribution to the National Security Space community, the Joint Force, and our operating forces. Your Marine Corps stands ready to meet the challenges of the 21st Century on land, sea, air, and space – now and in the future.

STATEMENT OF

Dr. Robert A. Calico, Jr. PhD

DIRECTOR OF ACADEMIC AFFAIRS

DEAN OF GRADUATE SCHOOL OF ENGINEERING AND MANAGEMENT

AIR FORCE INSTITUTE OF TECHNOLOGY

Before the

House Armed Services Committee

Strategic Forces Subcommittee

United States House of Representatives

on

July 22, 2004

Introduction

Chairman Everett, Congressman Reyes, and distinguished members of the Committee, good morning to my esteemed colleagues here today. I am Dr. Robert A. Calico, Jr., Dean of the Graduate School of Engineering and Management at the Air Force Institute of Technology. It is my pleasure to be here today to discuss the education of this nation's military space professionals.

As the Space Commission highlighted in its 11 January 2001 report: "Military space professionals will have to master highly complex technology; develop new doctrine and concepts of operation for space launch, offensive and defensive space operations, power projection in, from, and through space, and other military uses of space; and operate some of the most complex systems ever built and deployed." Clearly, world-class scientists, engineers, and operators are required in the crucial and unforgiving business of operating both manned and unmanned assets in space. These individuals come from academia, industry, and government. The key difference between the military space professionals and those involved in civilian space programs is the military utilization of space, as highlighted by the Space Commission. Space science is fundamental to both communities. It is the fusing of space sciences with technology, doctrine, and tactics that allows the space professional to accomplish assigned military missions. AFIT understands this very well as it executes its own mission of educating military space professionals. In this respect, AFIT does not stand in the shadow of any civilian academic institution and is proud of its past contributions in preparing officers for the space profession and is prepared to continue this role into the 21st century.

History

AFIT's history in providing leaders to the space community is long and proud. Included in AFIT's graduates are the father of the Ballistic Missile Program, General Bernard Schriever, two Mercury astronauts, Scott Carpenter and Gus Grissom, America's first African-American astronaut, Col (Dr.) Guion Bluford, and others.

As early as 1957, as the nation and the Air Force responded to the launch of Sputnik, space-related courses were added to existing curricula and the first class of the Astronautics program (later renamed Astronautical Engineering) began in 1958. This responsiveness to Air Force and national defense needs is just one example of many for AFIT.

Evolution of the space curriculum over the years mirrors that in other areas and is based on Air Force requirements. Beginning in the early 1970's, the Air Force developed a system for coding officer billets requiring Advanced Academic Degrees (AAD). Every officer position is coded as to whether or not an advanced degree is required. Positions requiring advanced education were assigned an Academic Specialty Code (ASC). For example, a position might be coded 4EGY, which would indicate that an astronautical engineer (4E) with a specialization in structures (G) was required for that position. The Air Force Educational Requirements Board (AFERB) meets annually to compare the educational requirements to the inventory of officers with those required degrees, to determine if additional officers require education and in what specific areas. This system, while able to track continuing requirements, was not designed to predict future trends. These trends are identified by AFIT working closely with its customer community. This frequently occurs through DoD organizations sponsoring student and faculty research projects. Active research by faculty working with students and sponsors identify new and emerging trends, which then translates into modified or new academic programs. This interaction is further enhanced by the fact that one-half of AFIT's faculty are military officers on four-year tours who bring their field experiences with them to AFIT, and subsequently take their AFIT experiences and connections back to the field.

An example of this process was the development in the late 1970s of the Graduate Space Operations program. Starting with the idea that a need existed for officers with experience in the operation of space systems who also understood the underlying engineering principals, a team of AFIT faculty traveled around the Air Force to organizations involved in space to define their needs. The result of this effort was the development of a curriculum that provided the critical interface between the operational organizations and the engineering community developing the systems. Instituted for the 13S (space and missiles) career field, this program provides a strong foundation of space systems to support military space operations, acquisition and policy

development. In addition, AFIT initiated the Graduate Aerospace and Information Operations (GAI) program in Fall 2001 as a direct response to an Air Force Space Command request to add information operations to the space operations program. The GAI program, part of the Air Force Space Command *Vigilant Scholar* program, retains the technical foundation of space science and engineering courses but also provides students with an understanding of how information is used, conveyed, assured, and denied.

While these programs are obviously relevant to space professionals, they are by no means the only AFIT programs that have served to prepare the Air Force's space cadre. The electrical engineering program has a thirty plus year history of providing education in navigation, space communication, space-based radar, remote sensing, and signal processing. The physics program has a similar history of providing graduates with expertise in space optics, space based laser systems, space atmosphere, and space power. Additionally the systems engineering program has provided hundreds of graduates over the past twenty-five years with expertise in space systems design.

Recent Developments

Traditionally AFIT has been funded by the Air Force to educate Air Force officers in numbers determined by quotas through the AFERB process. The education of sister service officers, DoD civilians, and international officers was on a space available basis. That is, if the Air Force failed to fill a designated quota, these other students could fill the empty seat.

In December 2002, SECAF and SECNAV signed an MOA creating an alliance between AFIT and the Naval Postgraduate School (NPS). Subsequently, the Commandant of AFIT and the Superintendent of NPS signed a follow-on MOU in April 2004. The purpose of this alliance is to ensure AFIT and NPS meet the advanced education requirements of the Armed Forces of the United States. One of the oversight boards established by the MOA is the Joint Space Oversight Board, chaired by the Director of the National Reconnaissance Office, which is chartered to pursue opportunities and initiatives that provide focused, timely graduate level education to the space cadre.

Current Space Education Programs

AFIT offers a wide range of graduate programs to meet the needs of space professionals. Until recently, 18-month Master's Degree programs and three year Doctoral Degree Programs were the standard for AFIT. In Fall 2003, AFIT expanded its offerings under the Graduate Space Systems (GSS) program. Students take a common space core, augmented with tailored sequences to meet specific Academic Specialty Codes, such as systems engineering, information warfare, and operations research. In addition to GSS, AFIT offers a traditional Astronautical Engineering degree, leading to an MS in 18 months and a PhD in 36 months.

Responding to the Air Forces new Force Development initiative, AFIT also developed a 12-month non-thesis Master's program aimed at high performing, mid-career officers. Execution of this initiative resulted in AFIT offering all degrees in a 12-month format as part of the Intermediate Development Education (IDE) program. The addition of IDE students will significantly increase the total enrollment at AFIT in space related disciplines.

Other initiatives continue to highlight AFIT's responsiveness to changing customer needs. AFIT developed a number of non-degree graduate certificate programs designed to provide focused graduate education over several weeks to months. The curricula for these certificate programs are managed through AFIT's Centers of Excellence: Systems Engineering, Directed Energy, Information Security, and Measurement & Signature Intelligence. All four centers have significant ongoing efforts in military space education and research. As an example, the Measurement & Signature Intelligence (MASINT) Certificate program is a ten-week, four course plus lab series, focused on the technical aspects of collecting, processing and exploiting non-literal, remotely sensed infrared (IR) and synthetic aperture radar (SAR) intelligence data. In this certificate program, the Space Physics specialty provides an understanding of solar effects on the near-earth environment and their ramifications to military systems and operations in space. As another example, the Operations Research (OR) program has an emphasis area in space systems analysis, in addition to five different OR course sequences having special relevance to the GSS program.

Curricula Development

AFIT has a long tradition in space curriculum development, dating back to 1958, when it was the first in the nation to develop an Astronautical Engineering curriculum. AFIT's current initiatives continue to be influenced by space education needs through continuing faculty interactions with the military space community. This interaction is further enhanced by the fact that one-half of AFIT's faculty are military officers that come directly from DoD organizations, many of which are part of the military space community. Trends and requirements are identified by AFIT working closely with the space community.

The Graduate Space Systems (GSS) program is designed to provide officers with a broad knowledge of space systems engineering and space science. Education in the fundamentals of these areas will increase military officers' effectiveness in planning, executing, and evaluating space systems and operations. Each student completes a research thesis on some aspect of space systems (engineering, science, or operations). The Space Systems graduate is ready to participate actively in organizations responsible for the selection, planning, management, operation, and evaluation of space systems for DoD.

The GSS curriculum is comprised of the following elements:

- (1) Mathematics
- (2) Core Courses
- (3) Specialty Sequence
- (4) Elective Courses
- (5) Thesis

The core program assures that all students have a broad background in the engineering and science of space systems and operations. The core program includes courses in orbit and attitude dynamics, telecommunications, space sensor systems, space environment, spacecraft engineering, and military space programs.

For technical depth, AFIT also offers a wide variety of specialty sequences in space engineering and science. A partial list of the more common sequences are: Advanced Astrodynamics, Aerospace Robotics, Control and Optimization Theory, Mechanics and Control of Space Structures, Rocket Propulsion, Space Facilities, Space Navigation, Systems Analysis and Design, Structural Analysis, Structural Materials, Communication Systems, Navigation Systems, Radar Systems, Laser and Electro-Optic Systems, Stochastic Estimation and Control, Target Recognition, Signal Processing, and the Space Environment.

The Graduate Astronautical Engineering (GA) program is designed to provide astronautical engineering specialists for the Air Force. The program leads to a master's degree in Astronautical Engineering and is fully accredited. This master's degree program provides the student with a broad education in the scientific and engineering disciplines associated with astronautical engineering. It is expected that our graduates will be prepared to: 1) make direct contributions as a practicing engineer to the area of astronautical engineering, 2) evaluate, monitor, and administer astronautical research and development projects, and 3) synthesize their professional expertise with the needs of the Air Force to produce new systems in the space arena. There are several different options associated with the GA program, including: Aerospace Engineering, Guidance and Control, Instrumentation, Rocket Propulsion, Space Facilities, and Structures.

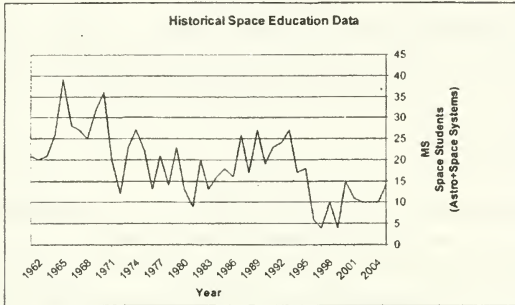
The Joint Space Academic Group

The mission of the Joint Space Academic Group (JSAG) is to be an integrated AFIT/NPS-level working group in support of the Joint Space Oversight Board, and to ensure that graduate-level education of the National Security Space Cadre leverages the strengths of both NPS and AFIT through collaboration and partnering.

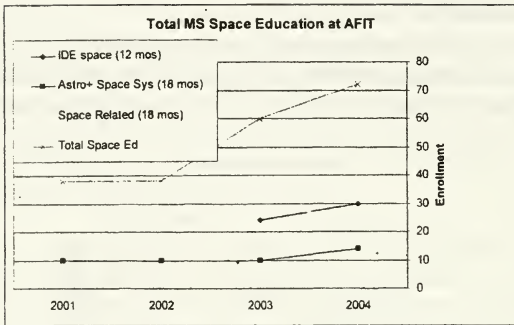
The JSAG is comprised of five members, two each from NPS and AFIT, and one outside member representing the National Security Space user community. The chair will alternate between the user community members.

Enrollment Levels

The first chart (below) shows the historical data for the total number of space students (Astronautical Engineering and Space Systems) who graduated with a Master of Science Degree. Not included are the students from other disciplines with a space related degree program.



The following chart shows the current enrollment in space education. In addition to the Astronautical Engineering and Space Systems students as shown above, students enrolled in 18-month space related degrees and the 12-month IDE space related degrees are reflected. Space related degrees reflect students enrolled in engineering and science programs other than Astronautical Engineering and Space Systems, but contain significant space related content. These programs include, but are not limited to, electro-optics, remote sensing, information warfare, space physics, global positioning system, and directed energy.



From the historical data in the first chart, the Air Force responded to Sputnik with a rapid enrollment in the space fields. Since then, there has been a steady decline. However, AFIT has benefited from a significant enrollment increase in the last few years in space education due to the Air Force's Vector Blue initiative, which will increase graduate education enrollment AF-wide up to four times its current level. The single largest enrollment jump is due to the IDE 12-month non-thesis students. The number of full time 18-month quota students has remained relatively constant since 2000, but will also increase significantly under Vector Blue. Bottom Line - there is still excess capacity in space education programs at AFIT.

Conclusion

AFIT's long and distinguished history in providing space education has served the nation well. AFIT continues to be responsive to the changing requirements of the military space community, offering defense-focused programs taught by a highly capable civilian and military faculty. Historically, enrollment numbers are well below AFIT's capacity, and pale in comparison to the post-Sputnik years. However, the Vector Blue initiative has positively impacted enrollment and reversed this downward trend. AFIT is a flexible, responsive educational institution and well suited to provide relevant, defense-focused education for the 21st century space warrior.

STATEMENT OF

CAPTAIN DANIEL W. BURSCH, USN

ASSOCIATE DEAN

GRADUATE SCHOOL OF ENGINEERING AND APPLIED SCIENCES

ASTRONAUT-IN-RESIDENCE, SPACE SYSTEMS ACADEMIC GROUP

NAVAL POSTGRADUATE SCHOOL

Before the

House Armed Services Committee

Strategic Forces Subcommittee

United States House of Representatives

On

July 22, 2004

Introduction. Mr. Chairman and members of the committee, on behalf of Rear Admiral Patrick Dunne, the Superintendent of the Naval Postgraduate School, I appreciate the opportunity to talk about the Naval Postgraduate School's continuing role in the education of America's space cadre. I am honored to be a Naval Astronaut and graduate of the Naval Postgraduate School (NPS), and I am the first of the 33 astronaut alumni of NPS to return as an instructor in the space systems curriculum. I also serve as the Associate Dean of the Graduate School of Engineering and Applied Sciences. The Naval Postgraduate School exists to increase the combat effectiveness of the Armed Forces by providing graduate-educated members of the Officer Corps, including the Space Cadre. High quality graduate education requires students to be knowledgeable at the cutting edge of their area, which in turn requires an active and innovative research program for students and faculty.

Background. The Space Systems Academic Group (SSAG) at the Naval Postgraduate School was established in October 1982 under sponsorship of the Navy Space Systems Division in response to the Department of Defense's (DoD) increasing dependence on space systems in support of military operations. This interdisciplinary group – comprised of faculty from traditional academic departments such as physics and engineering, and chair professors – oversees content and delivery of the two Space Systems curricula: Space Systems Engineering and Space Systems Operations. In the past 20 years, we have graduated over 560 Navy, Marine, Army, and Air Force officers in these two tracks; and

our graduates are currently spread throughout the entire spectrum of organizations in our nation's space community – military, intelligence, civil and commercial.

The Navy's space focus has always been grounded in the operational use of space. The 1950's saw the Navy bouncing signals off of the moon for communication; and, the next decade brought the Transit navigation system for Polaris submarines and the Galactic Radiation and Background (GRAB) system – the nation's first space-based electronic intelligence program. The Naval Postgraduate School Space Systems program has evolved from this heritage.

Many early Navy space programs were conceived, designed, developed, launched and operated by a relatively small, integrated group. The NPS Space Systems program has retained this end-to-end, systems engineering approach; beginning with a clear understanding of the end-user requirements, and finishing with the satisfaction of those requirements. As doctrine has evolved to its current transformational and information-centric state, our program has expanded to view the operational use of space across systems boundaries to integrated systems architectures.

Faculty and Chairs. NPS recognized early the need to bring a multi-service, multi-agency approach to space education. This led to the establishment of six Chair professorships sponsored by the National Reconnaissance Office (NRO), National Aeronautics & Space Administration (NASA), Navy Tactical Exploitation of National Capabilities (TENCAP), Navy Space Technology Program, Naval Network and Space

Operations Command, and Lockheed-Martin. In addition, the MASINT Chair Professor supports the SSAG in areas of Measurement and Signature Intelligence (MASINT). The SSAG also includes a USAF military instructor and astronaut-in-residence. These diverse participants with real world experience and expertise provide an invaluable resource for our Joint student body.

Systems Approach. The current state of graduate space education at NPS is one of breadth and depth. Through support of the related academic departments and the academic chair professors, NPS offers a Space Systems Engineering curriculum and a Space Systems Operations curriculum. Both curricula lay a foundation in the technical disciplines required for insight into space systems – the Space Systems Engineering curriculum focusing on an engineering discipline and the Space Systems Operations curriculum focusing on systems architecture and mission design and operations planning. The Space Systems Operations and Space Systems Engineering curricula are both designed to cover the “cradle-to-grave” spectrum of space systems:

- Requirements
- Science and Technology / Research and Development (S&T/R&D)
- Acquisition
- Operations

The students in both curricula share many courses, but the Space Systems Engineering students concentrate more on S&T/R&D and Acquisition, and the Space Systems Operations students concentrate more on Requirements and Operations. This systems engineering approach, with different relative weights for each curricula, provides a

synergistic “big picture” lacking in most “specialization” type programs. Within the Space Systems Engineering curriculum, elective sequences allow the students to focus on the advanced disciplinary content from other departments, such as physics, electrical engineering, astronautics and mechanical engineering, which are required for excellence in systems engineering of space systems. Master’s degree programs in Electrical, Astronautical, and Mechanical Engineering are accredited by the Accreditation Board for Engineering and Technology (ABET).

Curricula Content. The curricula and corresponding courses are built according to Educational Skill Requirements (educational competencies), accreditation considerations and through regular curriculum reviews performed by our senior leaders, including the Chief of Naval Operations N61 staff, Naval Network Warfare Command staff, Space and Naval Warfare Systems Command, and the NRO. These reviews ensure the content and focus of the program keep pace with a continuously changing world. Both curricula include an experience tour to gain familiarity with a majority of the National Security Space elements (including various USAF Space Command sites, Navy space sites, NRO, Central Intelligence Agency, National Security Agency, and NASA).

Capstone Courses. Both curricula include course sequences that culminate in a group capstone project. Space Systems Operations students complete a sequence in space architecture, and the Space Systems Engineering students complete a sequence in spacecraft design. Representatives from industry and National Security Space (NSS) activities attend the preliminary and final reviews of these projects. Quite often, the

project is based upon a request from a customer, such as the NRO. For example, recent capstone projects have focused on real-world Transformational Communications and Space Based Radar system requirements.

Relevant Research. AT NPS, our students have the opportunity to take courses and perform research at the highest classification levels or pursue hands-on research building spacecraft, such as the PANSAT (Petite Amateur Navy Satellite) spacecraft built at NPS and launched in 1998 from the space shuttle "Discovery". This practical, hands-on experience provides significant benefit in space acquisition management jobs after graduation. Many organizations interested in National Security Space have developed educational and research relationships with NPS. Our lab facilities are a model of cooperative efforts with the NRO, Naval Research Labs, the Air Force Research Labs and others. Just this year, NPS was awarded research contracts totaling over \$2 million for space-related research.

Distance Learning. The first NPS graduate course developed for the web was "Space Technology and Applications". The addition of three more web-based courses led to a space certification educational program taught using the latest technologies in distance learning. Through this program, we are able to provide space education to military members worldwide. This four-course sequence provides the foundation to understanding the integration of space capabilities across combined arms forces, involving networks, sensors, and weapons. Completion of these sequences could possibly shorten a student's stay at an NPS in-residence program.

Collaboration. The Air Force Institute of Technology (AFIT) and NPS alliance led to the formation of a Joint Space Academic Group (JSAG), which is comprised of faculty from AFIT and NPS, and includes another member representing the NSS user community. Initially, the charter of this group was limited to AFIT/NPS collaboration, but we realize that the charter should and will expand to include other institutions such as the USAF Space Operations School National Security Space Institute (NSSI) and other civilian institutions offering graduate-level space education. Accordingly, we also see the membership of the JSAG expanding. One of our goals is to develop a matrix of common Educational Skill Requirements or competencies for graduate space education, which would be part of the total list of competencies for the Space Professional. This will eventually allow flexibility so that the Space Professional Team can offer the right graduate education, for the right person, at the right time, for the right job.

Summary. Our mature curricula, interdisciplinary faculty, chair professors, long-standing organizational relationships and systems engineering approach all ensure that our graduates have a strong technical foundation, understand the operational use of space and are prepared to fill our nations most critical space positions.

In closing, I wish to thank the committee for your on-going support to our nation's security, to our nation's space programs, and to all of us in uniform. The Naval Postgraduate School stands ready and able to immediately execute space education

programs deemed necessary by this committee and our military leadership. Thank you for your time.

**STATEMENT BY
MR. JOHN W. DOUGLASS
PRESIDENT AND CHIEF EXECUTIVE OFFICER
AEROSPACE INDUSTRIES ASSOCIATION OF AMERICA**

**Hearing on Space Cadre and Space Professional Development
House Armed Services Strategic Forces Subcommittee**

July 22, 2004

Introduction

Chairman Everett, on behalf of the Aerospace Industries Association of America, or AIA, I wish to thank you, Representative Reyes and the Members of the Strategic Forces Subcommittee for the opportunity to testify this afternoon on the human capital challenges to the development of a flexible and technically proficient national security space workforce.

In the 21st Century, digital communications have become vital to the ability of the U.S. military to project power rapidly and effectively. Stable Defense Department space organizations, with transparent skill concentrations and established career plans, can subsequently function as key force multipliers since the United States faces new adversaries -- concealed in mountain ranges, embedded among city dwellers, or protected by rogue regimes -- whom we must confront through a combination of ground-based special operations and satellite-generated intelligence data.

I am therefore grateful, Mr. Chairman, for the chance to discuss the industry's perspective and initiatives regarding space workforce revitalization. AIA has a long record of leadership in addressing human capital issues since our member companies employ nearly 600,000 engineering and production workers. With approximately 80 regular and more than 150 associate members, we operate as the nation's largest trade association in the aerospace manufacturing arena.

Aerospace Industry Human Capital Trends

At the beginning of the nation's second century of flight, the civil aviation, space, and military assets of our industry have never made a more critical contribution to the economic and national security of the United States. This contribution, in turn, demands a skilled and motivated workforce.

The cultivation of a professional military space workforce, as the Rumsfeld Commission made clear, depends on the country's scientific and engineering capabilities. To support science and engineering occupations, industry and government must expand their education, recruitment, life-long training, and scholarship efforts. The United States

has lost more than 600,000 aerospace jobs in the last 14 years, and the industry's manufacturing sector employment stands at its lowest level since the Second World War.

While aerospace employment has declined significantly since the end of the Cold War, the industry accounts for four percent of the U.S. manufacturing workforce. Our industry as a whole, taking into account the supply chain and the indirect economic impact of products, totaled almost \$900 billion in sales last year and accounted for approximately one in seven American jobs.

The average age of the aerospace production employee, however, now exceeds 50 years; the same number for engineers rises to 54. In 2008, 26 percent of aerospace workers will become eligible for retirement. Government agencies confront similar demographic trends. NASA's personnel under the age of 30, for instance, are one-third the number over the age of 60.

As the workforce ages, technical professionals also migrate to other disciplines. Twenty-five years ago, aerospace companies employed 20% of the nation's R&D scientists and engineers; by 2001, the level had tumbled to 2.4%. At the same time, foreign nationals represent 41% of the students now earning engineering and science doctoral degrees in the United States. These young people often cannot qualify for sensitive domestic defense and space jobs.

Previewing future generations of workers, we find that the math and science testing performance of students in the U.S. relative to their European and Japanese counterparts gradually erodes to the 10th percentile or below by the end of high school. These aggregate figures confirm that aerospace companies face a dramatic shortage of technically-skilled professionals.

The National Security Space Sector: Incubator of Technical Workforce Renewal

National defense space agencies open a window on the broader workforce revitalization challenges to the aerospace industry. In his March 19, 2003 House Armed Services Committee testimony on National Security Space activities, for example, Secretary Teets identified a full spectrum of information, surveillance, and reconnaissance technologies sustained by America's space launch and satellite network. The Secretary added that the Air Force was building a cadre of professional acquisition and systems management personnel to deal with the complexity and high cost of deploying these technologies.

The November 2002 report of the bipartisan *Commission on the Future of the United States Aerospace Industry* also warned that anemic investments by federal research organizations could prompt the nation to forfeit the development of several "breakthrough capabilities" in high-performance computing, propulsion, and alternative fuels such as hydrogen for air vehicle engines. The space research and transportation sectors in particular both have a central role to play in the advancement of such capabilities.

From real-time enemy surveillance to streamlined procurement practices and more efficient energy sources, the skills applied by the American space workforce, Mr. Chairman, offer us a framework for the renewal of defense-related science, engineering, and technical occupations.

Reforming and Rebuilding the Aerospace Workforce of Tomorrow

AIA, along with the Departments of Defense, Labor, and Commerce, as well as a number of state employment agencies, have undertaken a variety of initiatives to revitalize the aerospace workforce. In the Pentagon, Department-wide human capital programs will prove necessary to surmounting the single largest barrier to the creation of a reliable cadre of military space professionals: a lack of leadership expertise. The Rumsfeld Commission's study of the 150 top DOD space operational positions revealed that less than 20 percent of the flag and general officers who hold these appointments had space career backgrounds. This trend disrupts the process of improving the performance of military space organizations through continuous, high-level guidance on strategy, execution, resource investments, and recruitment.

The bottom line is that if the Air Force fails to provide a clear and achievable career path to leadership positions for space professionals in its corps of general officers, the Service should and will lose its space-related missions.

In light of this problem, AIA strongly supports the Pentagon's ongoing effort, recommended by the Rumsfeld Commission and the GAO, to develop a National Security Space (NSS) human capital strategy.

We also commend Secretary Teets for his leadership in the creation of a mission-specific Air Force space curriculum with options for mid-career refresher courses. In addition, the Naval Postgraduate School and the Air Force Institute of Technology have started a joint graduate-level program for military space professionals.

From the industry side, AIA, in conjunction with its federal and state partners, launched the National Aerospace Workforce Initiative last December. Charged with devising solutions to what the *Aerospace Commission* termed a "devastating loss of skill, experience, and intellectual capital" in our industry, the Initiative brings together company representatives as well as officials from the federal government, organized labor, the states, and trade associations.

Over the last seven months, our Initiative Committee has begun the process of examining best practices that will eventually form the basis of a national aerospace workforce strategy. The core of this strategy centers on an effort known as *Solutions Aerospace*, a state-focused pilot program to identify gaps and incubate reforms in industrial base training, recruitment, skills development, and education. AIA has proposed that the *Solutions* pilot initially take root in the major aerospace states of

Alabama, California, Connecticut, Colorado, Ohio, Florida, Illinois, New York, Texas, Virginia, Washington, and Wisconsin.

AIA's recommended objectives revolve around action plans in each pilot state to meet the following challenges:

- combining the assets of state agencies and the federal government to execute the Labor Department's "power of e3" strategy (education, employment and economic development) through worker, student and faculty enrichment programs;
- establishing a program element to reduce factory and research facility turnover and harness the energies of non-traditional labor pools to stem the loss of technical talent;
- revising curricula to address K-12 math and science education, vocational training, and undergraduate courses of study; and
- creating online databases that list state aerospace job openings and alert students and entry-level candidates to workplace fellowship opportunities.

In support of *Solutions Aerospace*, Mr. Chairman, the Labor Department's Employment & Training Administration, under the diligent leadership of Assistant Secretary Emily Stover DeRocco, has acted on another key recommendation of the *Aerospace Commission* by convening an inter-agency federal task force to ensure that Washington and the states coordinate resources to reduce industry personnel and education shortfalls.

Secretary DeRocco's task force complements the second part of the AIA Initiative: *Destiny Aerospace*, which outlines a plan for expanded classroom instruction in math and science to stimulate student commitment to aerospace careers. *Destiny Aerospace* consists of elementary, high school, teacher training, and college work-study components. For the youngest students, *Destiny* proposes a series of curriculum tools to combine traditional instruction with technology and engineering case studies. Primary and middle school teachers, for example, would receive instructional packages that rely on aviation and space applications to explain affiliated math and science concepts.

This technique gains new dimensions during the high school years with field trips, extracurricular activities, and fellowship assignments. At the college level, *Destiny* envisions the recruitment of students to earn tuition and academic credits by supporting teachers in the elementary and high school programs and to serve as aerospace course-of-study counselors.

AIA has enhanced its space education activities by sponsoring an annual nationwide Team America Rocketry Challenge (TARC), the world's largest

competition of its kind. During the last two years, the TARC has attracted more than 16,000 students from all 50 states for a model rocket design competition to meet specific technical objectives, and we expect more than 10,000 participants in 2005. The friendly competition, teamwork, and pride in achievement generated by this event make the Rocketry Challenge an inspirational experience for new generations of scientists and engineers.

Finally, AIA commends both the FAA and NASA for their forward-looking approaches to workforce development. NASA's Human Resources Consortium serves as a model plan for the federal government. The agency's Education and Human Resources Enterprises have pioneered new scholarship and recruitment programs to narrow gaps in professional skills across the organization. This approach, by assigning responsibilities to all functional and program activities, makes the improvement of human capital a continuous institutional mission.

Solutions Aerospace and *Destiny Aerospace*, Mr. Chairman, draw on the time-tested practices of early inspiration and early intervention to revitalize our workforce. We have a compelling story to tell -- aerospace enterprises equip the nation not only to defend itself, but also to trade, communicate, and explore the galaxy at revolutionary degrees of precision. One of the missions of AIA is to persuade students and younger workers to rise as the future trustees of this revolution in the interest of making our economy more innovative and our homeland more secure.

Conclusion: Improving Life at Home By Exploring the New Frontiers of Space

Mr. Chairman, the critical requirement to sharpen the nation's military space capabilities reflects the larger benefits of restoring a safe and reliable space exploration program. The new national vision for the robotic and human navigation of the Moon, as well as long-term travel beyond Low-Earth Orbit, represents the most significant realignment of American space programs since the flight of Apollo 11 more than thirty-five years ago this week.

AIA has dedicated our organization to the task of moving the space exploration program into a new age. Delivering human space farers to the frontiers of the solar system will help us with the improvement of economic and physical life at home. The prospects for discovering more effective means of industrial production, transportation and environmental resource management, for example, show how the benefits of space can address the traumas and challenges of everyday life.

After the attacks of September 11th, search and rescue crews relied on space robotic technologies to survey the devastated site of the World Trade Center. Ultrasound techniques developed by NASA also allowed doctors to treat burn victims of that tragedy with greater speed and efficiency.

International developments similarly point to the importance of maintaining the role of the United States as the world's leading space power. For the first time ever, American competitors in Asia have undertaken human space flight programs. Moreover, the European Union has announced the ambition to overtake the U.S. in several commercial space activities during the next several years.

Space, Mr. Chairman, charts our future, because its proven benefits have allowed the United States to make dramatic strides in personal health, public safety, and national prosperity. The benefits of space allow us to overwhelm our adversaries by knowing their movements in advance. They allow us transform our economic and cultural lives by interacting and learning through high-speed satellite transmissions. And they alert us to potential diseases or disorders in time to take life-saving measures.

AIA therefore applauds the Subcommittee's interest in the space component of a high-skill, high-morale American aerospace workforce. Our commitment today can set the stage for decades of continued technological and educational leadership as global trade and investment intensify the engagement of the United States with the world. We appeal to both the Subcommittee and the Congress as a whole to continue their enthusiastic support for a national plan to reinvigorate this vital element of America's economy and national defense infrastructure.



John W. Douglass
President and Chief Executive Officer
Aerospace Industries Association



John W. Douglass is president and chief executive officer of the Aerospace Industries Association, which represents the nation's manufacturers of commercial, military, and business aircraft, helicopters, aircraft engines, missiles, spacecraft, materiel, and related components and equipment. Mr. Douglass became the seventh full-time chief executive of the

association in 1998. Before that he served for nearly three years as assistant secretary of the Navy for research, development and acquisition of defense systems for the U.S. Navy and U.S. Marine Corps.

A nationally recognized expert in systems acquisition, Mr. Douglass has extensive acquisition experience in Congress, the Defense Department, and the executive branch as a policy authority, contracting officer, engineering officer, test and evaluation officer, program control officer, and research director.

Before being named a civilian Navy executive, Mr. Douglass was with the Senate Armed Services Committee where he was foreign policy and science and technology advisor to Senator Sam Nunn and served as lead minority staff member for defense conversion and technology reinvestment programs.

Earlier Mr. Douglass completed 28 years of U.S. Air Force service and retired as a brigadier general in 1992. His numerous Air Force assignments included service as the deputy U.S. military representative to NATO as well as director of plans and policy and director of science and technology in the Office of the Secretary of the Air Force. He also served as special assistant to the under secretary of defense for acquisition.

Within the executive branch, Mr. Douglass was director of national security programs for the White House, responsible for formulating policy on a broad range of national security issues. He served as President Reagan's

personal representative to the Blue Ribbon Commission on Defense Management chaired by David Packard.

A native of Miami, Florida, he earned a bachelor of science degree in industrial engineering from the University of Florida, a master of science degree in industrial engineering from Texas Tech University and a master of science degree in management science from Fairleigh Dickinson University. Mr. Douglass has done postgraduate work at the Cornell University Center for International Studies where he was an Air Force Research Fellow with the Peace Studies Program.

Mr. Douglass is a member of the Board of Governors of the Aerospace Industries Association and chairman of the Board of Trustees of the National Center for Advanced Technologies. He served on the Commission on the Future of the United States Aerospace Industry, which issued its final report in November 2002. Mr. Douglass is chairman of the International Coordinating Council of Aerospace Industries Associations.

AIA Positions

Member, AIA Board of Governors
Chairman, Board of Trustees, National Center for Advanced Technologies
Chairman, International Coordinating Council of Aerospace Industries Associations

Member:

American Astronautical Society Board of Directors
Council of Manufacturing Associations Board of Directors.
National Association of Manufacturers
Chairman, International Coordinating Council of Aerospace Industries Associations
Defense Acquisition Excellence Council
FAA Research, Engineering and Development Advisory Committee
National Contract Management Association
University of Tennessee Aerospace Advisory Council
 (06.04)

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STATEMENT OF DR. PAM SHOCKLEY-ZALABAK

Written Testimony
House Armed Forces Committee
July 22, 2004

Good afternoon Chairman Everett, Ranking Member Reyes, and members of the Committee. I am Dr. Pam Shockley-Zalabak, chancellor of the CU-Colorado Springs campus. Leadership for the University of Colorado System is provided by President Elizabeth Hoffman.

I appreciate the opportunity to present to you how we have helped to address and continue to contribute to the important development of space professionals in the all aspects of space systems design, implementation, and operation.

The University of Colorado at Colorado Springs is one of three campuses in the University of Colorado system, a national leader in teaching, research and service.

CU-Colorado Springs emphasizes a broad range of degree programs in the liberal arts and sciences and professional programs in business, engineering, nursing, education and public affairs. The university is ranked as a top Western regional university and enrolls about 8,000 students annually.

Because of its close engagement with the community of Colorado Springs including the United States Air Force Academy, Peterson Air Force Base, Schriever Air Force Base, Fort Carson, NORAD and Air Force Space Command, CU-Colorado Springs is uniquely positioned to assist in the development of space professionals.

We have long recognized the challenges faced by the military and others in developing a professional space cadre. CU-Colorado Springs began its support of the education of space professionals in the mid-1980's after the establishment of the U.S. Space Command in Colorado Springs. Hundreds of Air Force officers are graduates of campus-based programs and have had distinguished careers in space career fields. The Department of Mechanical and Aerospace Engineering focuses on space systems design and offers a Master's of Engineering Degree in Space Operations to military officers, NASA employees, and private industry employees through the use of Internet-based offerings.

The CU System, through its Colorado Springs and Boulder campuses, currently provide numerous programs that demonstrate ability to work cooperatively with various branches of the military, industry and other academic institutions.

Central among these efforts is the Colorado Springs-based Network Information and Space Security Center (NISSC) led by Dr. Bill Ayen. A concept originally developed in partnership with U.S. Space Command and its leadership, General Ed Eberhart and Major General Dale Meyerrose, the center's mission shifted following the events of Sept. 11,

2001 to directly support key military commands such as U.S. Northern Command, Air Force Space Command and the Air Force Research Laboratory.

NISSC provides innovative education and research programs across broad areas of homeland security, homeland defense, information assurance, and space systems engineering and management. In cooperation with university departments, the center offers three graduate-level certificate programs. They are: Certificate in Homeland Security, Certificate in Information Assurance, and Certificate in Secure Software.

NISSC worked with U.S. Northern Command to create graduate-level courses for civilian and military staff. This fall, 20 individuals will complete a certificate program at Peterson Air Force Base and a new cohort group will begin. Campus-based students also have access to courses, preparing regional homeland defense and homeland security workforces for critical tasks. In cooperation with U.S. Northern Command, the university plans to make this educational program available by Internet delivery.

Through NISSC, CU-Colorado Springs is a founding member of the Homeland Security / Defense Education Consortium. This consortium was formed by U.S. Northern Command as a network of teaching and research institutions focused on promoting education, research, and cooperation related to and supporting the homeland security / defense mission. Since its inception, more than 30 institutions have joined in this important endeavor.

Joint research efforts are conducted by CU-Colorado Springs and U.S. Air Force Academy faculty, including the design and construction of satellites. A Cooperative Research and Development Agreement specifies the relationship between the institutions. A similar agreement was recently executed with Sandia National Labs.

Other CU-Colorado Springs departments that support space-related research, include Electrical and Computer Engineering, Physics, Mathematics, and the College of Business and Administration.

Specific CU-Colorado Springs academic and research programs include:

Academic Programs

- **Mechanical and aerospace engineering graduate degrees.** The department offers two master's degree options in the space field, a Master's of Engineering in Space Operations and a Master's of Science in Mechanical Engineering with a space systems track. Internet-based course offerings allow service members to begin a degree in advance of deployment to the Colorado Springs area. These students can also complete a degree if they are re-deployed. To date, 59 students have graduated from these programs. A Ph.D. in Engineering is also available.
- **Certificate programs serving the needs of the military.** Through a College of Engineering and Applied Science and NISSC partnership, an Information Assurance Certificate and a Secure Software Certificate is offered to officers from all service branches at Peterson Air Force Base.

- **Other graduate degrees.** The College of Engineering and Applied Science offers a Master's of Engineering in Information Assurance to support the training and education need of military personnel. The college is developing a Master's of Engineering Telecommunication degree to support the training of personnel at NORAD.
- **Undergraduate support.** Through Internet-based distance learning, military personnel have completed undergraduate degrees while stationed throughout the globe.
- **Research Programs.** CU-Colorado Springs academic departments are actively engaged in interdisciplinary applied and theoretical research to support space cadre development. These efforts are particularly active in the College of Engineering and Applied Science, NISSC, and are conducted in coordination with faculty at the U.S. Air Force Academy and with private industry.

Specific CU-Boulder academic and research programs that support professional space education include the Laboratory for Atmospheric and Space Physics (LASP) which has contributed to NASA space science missions for more than 50 years, the Center for Astrophysics and Space Astronomy (CASA) which has carried out numerous space hardware programs, and the Department of Astrophysical and Planetary Sciences (APS) which is devoted to teaching and research in astrophysics, planetary sciences, and space physics. The Center for Science and Technology Policy Research focuses on science and technology policy, including space policy, and recently initiated a certificate program in science and technology policy focused on training scientists and engineers for careers that span science, technology, and policy.

The CU System's strong space education and research programs allow it to work cooperatively with the Air Force Space Command and with major universities across the country to collaborate on academic programs that will improve the accessibility and quality of space-related programs for the many military personnel, industry employees, and others who do not have the opportunity to complete in-residence programs.

With an eye toward the future, and in cooperation with the Colorado Springs-based Space Foundation, CU-Colorado Springs entered into a cooperative agreement to provide specialized K-12 curriculum in space education. The goal of this interdisciplinary, broad-based approach is to invigorate American innovation and increase the workforce in science and engineering. The Space Foundation is a national non-profit organization that advances and supports civil, commercial and national security space endeavors and educational excellence.

At CU-Colorado Springs, our most significant initiative in support of the development of space professionals will be to serve as the designated higher education representative for Air Force Space Command for the purpose of establishing and managing a consortium of premier research institutions and other appropriate organizations to serve the broad educational needs of the military space community.

The goal of the Space Education Consortium is to be recognized as a national and international organization of excellence for space education to achieve national security objectives.

CU-Colorado Springs will develop and coordinate Space Education Consortium functions relating to Air Force Space Command educational initiatives and foster broader space-related education and research activities through member institutions. The consortium will focus on promoting education, research and cooperation supporting the development of the space cadre to advance space systems design, development, operation and application.

The consortium's interests will include a broad spectrum of space operations in all environments. Underpinning the consortium will be a series of agreements that allow students to take courses from consortium members, plan educational programs, receive degrees and transfer credits among member institutions.

Five tenets of the consortium mission are:

- Ensure the military space role and perspective is adequately and accurately reflected in educational initiatives.
- Promote and facilitate space-related education program development
- Focus and facilitate space-related research and development
- Encourage cooperation between consortium institutions
- Facilitate the ability to obtain appropriate degrees and other educational programs for space professional development.

The university's approach to consortium membership will be inclusive and will include higher education institutions, military schools and educational institutions and other organizations that foster the advancement of space education.

An advisory board of consortium members and Air Force Space Command representatives will manage membership activities. In fulfillment of its lead university role, CU-Colorado Springs is targeting Oct. 1 as the date for formation of the initial consortium including articulation agreements, membership of steering and advisory committee and launch of a consortium web site.

Thank you for allowing me to address this committee.

July 22, 2004

**Opening Statement to the Strategic Forces Sub-Committee,
House Armed Services Committee
By Profs. Victoria L. Coverstone and Rodney L. Burton
Testimony of July 22, 2004**

The Education of University of Illinois Engineering Students to be Space Professionals

Mr. Chairman and Members of the Committee,

I am Victoria Coverstone, Professor in the Department of Aerospace Engineering at the University of Illinois at Urbana-Champaign. I appreciate the opportunity to appear before you today, to discuss a subject of critical importance to the security of the United States – the education and training of young men and women in the knowledge, and skills needed, to achieve military and scientific objectives in the space arena. My message to you today is that the pool of talented domestic students interested in careers in space remains large and highly motivated, but the lack of financial support and pipelines to these careers too often diverts them into other fields of study.

The University of Illinois is known for graduating large numbers of students with B.S., M.S. and Ph.D. degrees in aerospace and aerospace-related fields. Illinois is one of the highest ranked engineering colleges in the country, and our students are among the nation's best. But just as important is the high motivation of these students for space careers with the military, NASA, and industry. Polls of our students consistently show that they have been dreaming of careers in space, as astronauts, engineers and scientists, since age 10 or even earlier. The strong motivation of these talented students represents a tremendous resource for the future of space development.

It is our opinion that this student resource is being severely underutilized. Our best students sometimes have difficulties supporting themselves through school. More scholarships, fellowships and research dollars, as well as job offers upon graduation, are needed to increase the number of space professionals. I hope you agree that much more must be done in supporting these students.

I want to report to you that the University of Illinois strongly supports our efforts to educate these excellent young students in space science and technology. We offer a broad-based education in aerospace fundamentals. But opportunities for education in space-related disciplines are much more than classroom lecture courses. We also stress the importance of hands-on experiences. For example, our multi-disciplinary Illinois Observing Nanosatellite project offers undergraduate and graduate students a creative window into practical space mission design. We also heavily emphasize teamwork skills as highlighted in my department's two-semester senior design course. I am proud to say that these space system designs always do very well in national competitions, in some years bringing in the first, second and third place prizes.

The University of Illinois is the lead institution for the NASA Space Grant College and Fellowship program in our state. The Space Grant brings together the research efforts of the

University of Chicago, Northwestern University, the Illinois Institute of Technology, and of course my University, to support research and to provide student support in space research. My University's latest effort is the establishment of the Center for Human and Robotic Space Exploration, with the purpose to train future leaders and develop the fundamental scientific and engineering expertise needed to achieve our vital national goals.

In conclusion, my message to your Committee is that my University very strongly supports national efforts to develop space capabilities and educate and train first-rate students. All that is needed is the financial support for these already motivated students, anxious for careers as space professionals.

**QUESTIONS AND ANSWERS SUBMITTED FOR THE
RECORD**

JULY 22, 2004

QUESTIONS SUBMITTED BY MR. EVERETT

Mr. EVERETT. To what extent, in your opinion, has the designation of an Executive Agent for DOD space within the Air Force contributed to integration of space professionals across the services?

General DODGEN. The designation of an Executive Agent for Space has been extremely positive and has been the single most important reason there has been integration. There has been considerable movement in the past six months towards integration driven in large part by the EA and NSSO staff. Services have been afforded the flexibility to develop our cadres to meet our unique needs and as we've done that, NSSO has established working groups to ensure we are all abreast of each other's programs. The Army anticipates further integration in the upcoming six months as we all address our certification processes and how that applies to issues such as Space Critical Positions.

Admiral McARTHUR. Mr. Teets, our Executive Agent, has been instrumental in the coordination of common goals and objectives for the development of cadre, to include a Space Professional Oversight Board to oversee the education process at key institutions. As the focal point for National Security Space, he has developed a coherent strategy and has the authority to pull the entire cadre together. We continue to work with his staff on the refinement of these goals, data collection processes and implementation of the Department of Defense Space Human Capital Strategy.

General THOMAS. The EA for Space has done an excellent job of integrating the space cadre across the Services and the NRO. The EA has recognized that "one size doesn't fit all" and has respected and supported the Services' individual efforts and requirements while simultaneously focusing the efforts of the DoD toward specific goals and a defined end state. The work that has been done to integrate training and education, the completion of the Human Capital Resources Strategy, the establishment of oversight boards and working groups, and the establishment of the National Security Space Office have all contributed to a greater understanding and integration of the Services' respective cadres. There is no question that each of the Services' cadres are stronger and better through the coordination and integration efforts of the EA for Space.

Mr. EVERETT. Please explain your concept of the core competencies and critical skill sets required for an effective space cadre.

General LORD. Identifying, tracking, and managing space expertise is the centerpiece of space professional development. In fact, this is what distinguishes Space Cadre members from other occupational specialties in the Air Force. In order to build the right Cadre, we've identified nine categories of space expertise that we need to develop and manage. They are: Satellite Systems, Nuclear Systems, Spacelift, Missile Warning, Space Control, Intelligence-Surveillance and Reconnaissance, Kinetic Effects, Space Warfare Command and Control, and a general category for all other types of space experience. For tracking purposes, we created alphanumeric designations associated with each of these categories known as Space Experience Codes or SPECS. They are used to describe an individual's expertise as well as the position requirements for each space-coded billet. It is important to understand that SPECS apply regardless of what space career field or specialty an individual serves in—operators, program managers, scientists, engineers, etc. To date we've categorized over 7000 active duty Space Cadre members using these codes. Soon we will evaluate our government civilian force as well as Guard and Reserve members—around 3000 additional people. This gives us a similar capability to the flying community. . . i.e. when they list the types of aircraft an individual has experience, they are documenting *breadth*, and when they track how many flying hours an individual has in each of those aircraft, they are capturing *depth*.

General DODGEN. The seven core Army values are non-negotiable and provide a foundation for our cadre (Loyalty, Duty, Respect, Selfless-Service, Honor, Integrity, Personal Courage). Core space competencies include an understanding of the space environment, space systems fundamentals, space mission areas, joint deliberate and crisis planning, information operations, space policy and doctrine, space requirements determination and acquisition processes, and understanding of US government, threat, and civilian/commercial space capabilities. Critical skill sets are Intel-

ligence, Surveillance and Reconnaissance (ISR) integration, planning and collection management, satellite communication capabilities and planning, Navigational Warfare (NAVWAR) planning and integration (Global Positioning System and Blue Force Tracking), theater and global missile warning capabilities and processes, Weather, Terrain and Environmental Monitoring (WTEM) and space control capabilities.

Admiral MCARTHUR. Our core competencies are as follows: requirements, policy, and plans; research and development/science and technology; acquisition; operations, to include adversary use of space; and assessment. Active involvement in these five areas is critical to maintaining space systems throughout their lifecycle.

General THOMAS. First and foremost, the Marine Corps' space cadre must be comprised of "space-smart Marine Air-Ground Task Force (MAGTF) officers"; this means that our space cadre personnel must be well-grounded in their primary Military Occupational Specialty and have a firm understanding of maneuver warfare and the MAGTF. Once they have reached this level of understanding, we provide them with space education and/or training, this allows them to put the capabilities that space offers into an operational context.

- As such, we feel that space education and training must be focused on the ability to develop a plan to employ space capabilities in consonance with operational maneuver. The skills that are required to be able to do this type of planning are:

- An understanding of the military advantages of space
- An understanding and familiarity with space based capabilities
- A familiarity with space architectures
- A familiarity with orbital mechanics
- A familiarity with the Joint Operation Planning and Execution System
- An understanding of how space capabilities can support operational maneuver
- An understanding of how to obtain space support from the NSS Community

Mr. EVERETT. How do you define your space cadre?

Secretary TEETS. At the DoD level we have found it useful to not define the term "space cadre" but rather let each individual service define their cadre to suit their unique needs. That said, I can describe the space cadre as a total force team, comprised of active duty and reserve officers and enlisted and civilians who operate and acquire space systems and integrate space systems into joint warfighting and intelligence collection.

General LORD. Obviously each Service's Space Cadre will be different based on size and type of experience. Our Space Professionals are a Total Force of active duty, Guard and Reserves, which are each comprised of officers, enlisted and government civilians that take space systems from concept to employment. It also includes many specialties, such as communications, contracting, weather, intelligence and others, that may or may not spend the preponderance of their career in space-related activities. A subset of this overall population of Space Professionals is known as the "Space Cadre," which is currently composed of scientists, engineers, program managers and operators, the group that was primarily the focus of the Space Commission. Members of this Cadre will be scheduled to attend Space 100, 200, and 300 and fall under the purview of the three-tiered Space Certification Plan.

The Space Certification program, not only gives us a means to measure the health and status of the entire Space Cadre, but it also provides individuals with clear standards and expectations from the Space Professional Functional Authority. The program is built on levels of education (Space 100, 200, 300) and space-related experience. Level I requires Space 100 and one year of satisfactory performance in space-related activities; Level II requires Space 200 and six years of satisfactory performance in space-related activities; and Level III requires Space 300 and nine years of satisfactory performance in space-related activities.

General DODGEN. Current Army space cadre are, "Officers with technical knowledge of the environment, system composition and technologies for space. Consisting of primary staff positions down to the divisional level, space cadre officers are responsible for formulating policy, developing operational concepts, conducting research, developing technologies and planning, evaluating and implementing the tactics and techniques for the operations and use of space systems."

The working, draft definition of future Army space cadre as determined in the FORMAL process is, "Soldiers and civilians whose principal duties include planning, developing, resourcing, acquiring, integrating, or operating space forces, systems, concepts, applications, or capabilities in any element of the four primary mission areas within the domain of space operations as defined by Joint Publication 3-14."

Admiral MCARTHUR. Although we have only identified the officer cadre to date, the Navy space cadre is a distinct body of expertise that is horizontally and vertically integrated within existing active duty and reserve unrestricted and restricted

line communities and government civilians organized to operationalize space. This includes officers and enlisted.

General THOMAS. A cadre of Marines (active duty, reserve, and civilian) with a diverse set of primary Military Occupational Specialties (including Ground, Aviation, Combat Support, and Command and Control) who are:

- Trained in joint space operations planning;
- Educated in National Security Space (NSS) activities; and
- Experienced in space requirements generation, concept development, planning, programming, acquisition, and/or operations

Mr. EVERETT. Please discuss your thoughts on how to address shortfalls of space professionals in the industrial workforce.

Secretary TEETS. The Space Human Capital Resources Strategy does not address shortfalls of space professionals in the industrial workforce. However, we have begun an industrial base study to help us understand what needs to be done so that industry can deliver technology and develop programs that meet warfighter's expectations for performance, cost and schedule. Additionally, I continue to work this issue as a priority with the members of the Partnership Council, composed of myself, the Administrator of NASA, the Director for Defense, Research and Engineering, the Commander of US Strategic Command, and the commander of Air Force Space Command.

General LORD. While the AF Space Professional Strategy does not specifically apply to our corporate partners, nurturing and developing the space industrial base remains vitally important to the Air Force and our Nation. We will certainly continue to leverage and incorporate industry best practices into our own program and we hope they might find value in some of our ideas as they develop their own space professional workforce. Areas that remain mutual priorities for both the Air Force and industry are recruitment and retention of skilled engineers.

General DODGEN. The shortfall must be addressed with a long term strategy targeting the nation's youth at the elementary school level to encourage enthusiasm about the space industry and plant the seed as early as possible. Additionally, investments should be made in educational programs associated with the space industry to keep students interested and motivated towards a career in space as they progress through high school. Increased opportunities for college internships may also assist. In the short term, industry should consider hiring personnel with less space specific training and education and, once hired, provide intense, specialized training to bring employees up to standard. As an example, soldiers leaving the military may have the expertise and experience to contribute as part of the industrial space workforce, but may lack formal education. These soldiers could help fill critical shortages in the industrial workforce and provide a "win-win" solution for both industry and the Army.

Admiral MCARTHUR. My focus to date has been on establishing a strong Navy space cadre (officers, enlisted and civilians). One way we are addressing shortfalls of space professionals in the industrial workforce is through our Space and Network Warfare Program with our naval reservists. This program allows individuals in industry to work in the Navy space program, developing space expertise they can return to their civilian jobs.

General THOMAS. The Human Capital Resources Strategy did not address the industrial workforce, and this is not an issue that the Marine Corps has been actively involved in. We have, however, supported the EA for Space's efforts to assess industry's capabilities and shortfalls.

Mr. EVERETT. The Department of Defense Space Human Capital Strategy suggested the importance of data collection for the purposes of developing a space cadre. What specific data are each of you collecting and what value has it provided?

Secretary TEETS. The strategy calls for the collection of data necessary to manage the cadre from a DoD perspective. At a minimum the data collected will address: the size of the space cadres; number of space cadre positions; space cadre skills; space cadre competencies; retirement eligibility and personnel availability projections; promotion and retention rates; requirements for space cadre members. We believe that the data will provide an overarching view of what we have, what we need, where the cadre is heading and insight into special interest items mentioned above.

General LORD. As stated before, we are working closely with the National Security Space Office (NSSO) on developing and implementing the overall DoD Space Human Capital Strategy. As far as data collection is concerned, we are primarily focused on our new AF Space Database and Space Experience Codes to quickly locate and identify every individual in the Space Cadre, measure the depth and breadth of their space expertise, assess their certification level, and verify whether they possess an operations or acquisition background or both. This information is necessary for gauging the health of the Cadre, which will influence future assignment guid-

ance and policies. In short, it will greatly assist us in putting the right person, with the right expertise, in the right job, at the right time in their career. From that standpoint, the value of this data is simply enormous.

General DODGEN. The Army is collecting data in four areas for our current cadre; rank/experience, training, education, and utilization. We track promotion rates to ensure our cadre are promoted and developed at or above Army averages. We track officer training and education to ensure our officers are qualified to serve throughout the force, and that we select those with the most extensive or specialized training/education for the right assignments. We also collect data to track officer assignments to ensure key authorizations are filled and that officer assignments are balanced across the space mission areas for personal professional development.

The data we are collecting in support of the FORMAL process to determine our future cadre is focused on the duty description of space billets to determine which units and assignments would potentially require a qualified space cadre member. That data will be used to determine the military occupational specialty (MOS) and skills required to fill the billet, which will shape the potential pool of the future cadre.

Admiral MCARTHUR. Navy currently tracks the number of active duty officer space cadre members, the number of active duty officer space billets, the education/experience level of cadre members, and active duty officer cadre promotion rates. We are working with the National Security Space Community to define potential additional data requirements.

General THOMAS. We have collected data in the following areas:

- Number of USMC personnel who have space education, training, and experience (active and reserve)
- Number of USMC personnel by grade who have space education, training, and experience
- Number of billets that have been designated as requiring space cadre personnel
- Number of billets that need to be designated as space cadre billets
- Requirements for space education and training
- Requirements for graduate education in space operations
- Number of personnel enrolled in the Command and Staff College Distance Education program
- Preliminary promotion statistics for Space Operations Officers (MOS 9666)

Mr. EVERETT. What is the status for you on development of a detailed plan, including goals, metrics and schedules, to implement the Human Capital Strategy?

Secretary TEETS. The DoD's implementation plan is under development. We will complete and deliver to the Congressional Defense Committees a detailed implementation plan NLT 15 NOV 04.

General LORD. The Air Force has a solid approach and aggressive schedule for implementing Space Cadre development. Our program consists of six major steps: 1. Identify the Space Cadre and track experience; 2. Develop a continuum of space education courses; 3. Develop a three-tiered Space Cadre Certification Program; 4. Identify prerequisite experience and certification levels for each Air Force space-related position; 5. Develop career planning guidance and issue assignment policies; 6. Establish a permanent Space Professional Management Office.

I am proud to say we've made significant progress in all of these areas. First, we've already identified and categorized over 7000 active duty Space Cadre members with our Space Experience Coding process. The Guard and Reserves are not far behind and the civilians will follow later this year. We will have Space 100 ready for the classroom in October 2004, and over 200 students from all Services and agencies have already graduated from Space 200. Meanwhile, Space 300 is gearing up for a prototype class in October 2005. The Space Cadre Certification Program is also in place and our 7000 active duty Cadre members are working to meet the requisite qualifications. In addition, we are working to identify the required space experience and certification level for each space-related position. There is certainly more work to be done in this area, but we expect to have the majority of the positions coded by Spring 2005. Naturally, as we get more fidelity into our space requirements, we must continue to coordinate with other Functional Authorities and assignment processes to best exploit our expertise to meet the needs of the National Security Space community and the Air Force. To help me oversee and administer all of these activities, we stood up a permanent Space Professional Management Office at Air Force Space Command on 1 July 2004. This office evolved from a Space Professional Development Task Force established in October 2002.

General DODGEN. The Army is working with NSSO and the other Services to implement the Human Capital Strategy in accordance with the established timelines outlined in the plan. We will participate as part of the Human Capital Resource

Working Group in the development of goals, metrics, and schedules. We are currently in the initial stages of this effort, but are keeping pace with the implementation plan and our November 2005 schedule. (Note: Not certain what schedule is being referred to. If it's the ASCF schedule, this date should be August 2005.)

Admiral MCARTHUR. Navy is working closely with the National Security Space community to develop the Space Human Capital Strategy Implementation Plan. Additionally, Navy is developing its own Space Human Capital Strategy as part of Chief of Naval Operations guidance for an overall Navy Human Capital Strategy. As part of that effort, Naval Network Warfare Command submitted its overarching human capital strategy, which includes the Navy Space Cadre, to Fleet Forces Command and the Navy Personnel Command on 25 August 2004.

General THOMAS. The Marine Corps produced its strategy for developing a cadre of space professionals as part of the DoD Space Human Capital Resources Strategy. We then developed a Plan of Action and Milestones that provides our detailed plan, annotating our goals and schedule for implementation of our space cadre. We also have established a Space Cadre Working Group that is comprised of personnel from Headquarters, U. S. Marine Corps (HQMC) Departments of Manpower and Reserve Affairs and Plans, Policies and Operations as well as the Marine Corps Combat Development Command. This group is supported as required by personnel from other HQMC space cadre stakeholders, to include Training and Education Command, C4 Department, and Intelligence Department. The space cadre working group is producing a charter that will include a way ahead for the management of the space cadre once implementation is complete. While these documents show our way ahead, we also recognize that space cadre development and implementation will be an ongoing and changing process as we continue to evaluate our role and equities in National Security Space.

Mr. EVERETT. How do you the Executive Agent for Space, in conjunction with leaders in the military departments, monitor implementation of the key action in the DoD space human capital strategy? When will an implementation plan be developed for the strategy? How long will it take to implement the strategy?

Secretary TEETS. I monitor the implementation of the strategy through the Space Professional Oversight Board (comprised of the space cadre focal points within each service) which meets quarterly. An implementation plan for the strategy is under development and will be delivered to the Congressional Defense Committees NLT 15 NOV 04. Until the implementation plan is completed and approved it is premature to speculate on specific milestones. Many efforts are well underway, and since the strategy focuses on an enduring cadre of space professionals, the implementation will have no specific end.

Mr. EVERETT. Given that the military services are charged with developing their own space cadres, how do you as Executive Agent intend to promote the integration of the services' space career fields and ensure that the needs of DoD's total force, including joint requirements, are met?

Secretary TEETS. To promote integration and ensure DoD's requirements are met we created the Space Human Capital Resources Strategy. Though we will integrate and synchronize activities such as training and education, the DoD Space Cadre will be composed of four individual service space cadres each with individually tailored career fields.

Mr. EVERETT. What are your priorities for further synchronizing the services' space cadre development efforts and how will you address them?

Secretary TEETS. The highest priority for synchronization is education and training. To that end our strategy calls for and we are planning to hold an education and training summit. This conference will bring together members from academia, professional military education, military graduate education programs and others. It is tentatively scheduled for mid-September.

Mr. EVERETT. How is the interdependence of commercial and military space in the areas of communications, intelligence, and launch being integrated into space cadre education and training?

Secretary TEETS. The only education and training which is influenced by the interdependence of commercial and military space in the areas of communications, intelligence, and launch is in the arena of applying space capabilities to joint warfighting. Recognizing what the commercial world "brings to the fight" is a critical part of the training we give to all our officers who go forward to the theater. Interdependence does not does not affect operational training.

Mr. EVERETT. What guidance have you given the services in terms of the type of data you would like to see collected for the purposes of developing a space cadre?

Secretary TEETS. The strategy calls for the collection of data necessary to manage the cadre from a DoD perspective. At a minimum the data collected will address: the size of the space cadres; number of space cadre positions; space cadre skills;

space cadre competencies; retirement eligibility and personnel availability projections; promotion and retention rates; requirements for space cadre members.

Mr. EVERETT. Please explain your concept of core competencies and critical skill sets required for an effective space cadre.

Secretary TEETS. We believe that there are core competencies and critical skill sets which must be identified to help develop our space cadre. We are in the process of identifying them. Once identified, these competencies and skill sets can be used to assist in education and training development, certification etc. . .

Mr. EVERETT. Please explain the concept of the National Security Space Institute and its progress. What is the status of the Air Force's initiatives to revise and standardize its space education and training? To what extent will future space training be made available to space personnel from the other services?

General LORD. Our concept of the National Security Space Institute (NSSI) is a logical growth of the Space Warfare Center's Space Operations School (SOPSC). We want the SOPSC to grow into the NSSI and become the go to place for DoD military space education—very much like the Joint Special Operations University is a one-stop shop. The SOPSC currently teaches all Services on a variety of space-related subjects. We want to partner with the Army, Navy and Marine Corps so the NSSI will be their center of military space education. We are currently defining the scope and requirements for the NSSI.

By transforming the SOPSC into the NSSI, where we will have increased participation from other Services, we will be better positioned to eliminate redundancies and standardize military space education not only in the Air Force, but between the other Services as well. SOPSC already reviews curriculum from other sources to ensure the relevancy and currency of space-related instruction. For example, SOPSC recently assisted in developing the Space Specialized Study block for Air Command and Staff College at Maxwell AFB in Alabama. As the go to place for military space education, we envision the NSSI reaching back to Professional Military Education sources to ensure space is infused and fully integrated into the history and lessons being taught.

Space is inherently joint; therefore, space education must also include the other Services. In that spirit, Space 200 and 300 were designed with input from Army, Navy and Marine Corps representatives, as well as from other government agencies. In turn, the scheduled classes are attended by members from all Services and agencies to enhance the integration and understanding between operators, acquirers and users. For example, the Army is using the Air Force's Space 200 class as the introduction course to their Functional Area 40 (FA 40) training.

It is important to note the NSSI is separate and distinct from our premier academic institutions, like the Air Force Institute of Technology and the Naval Postgraduate School, where students are immersed into fulltime space-related degree programs.

Mr. EVERETT. Recent press articles have reported that military space operators were not always able to meet the needs of warfighters in recent operations. What are your priorities for improving the capabilities of space operators to provide better space warfighting support?

General LORD. First and foremost, we are focusing hard on continually improving our education and training to support the combatant commanders. That is the goal of our new continuum of space education for the Air Force Space Cadre. With the creation of Space 100, 200 and 300, we are ensuring the appropriate level of instruction is given to both our operators and acquirers. By including other Services, we also get the user perspective. Additionally, we are building in-depth Advanced Space Training (AST) courses in a number of very specific mission areas. We just recently completed an AST offering on Navigation Operations. The graduates from this particular class are now extremely knowledgeable on all aspects of Positioning, Navigation and Timing. They have already returned to their units to begin sharing their new knowledge—to raise the level of understanding for the entire unit. In the near future, other ASTs are planned on topics such as Missile Warning, Intelligence-Surveillance and Reconnaissance, Space Control and others.

Additionally, we have a Space Division at the Air Force Weapons School where we ensure space operators and space capabilities are fully integrated into combat operations. It's an intensive 6-month school where we learn what the users' needs are and how space can be brought to bear to meet those needs.

Mr. EVERETT. How does the Air Force plan to spend current funds set aside for the development of its space cadre?

General LORD. Space Professional Development is the key to ensure we have enough qualified people to meet National Security Space needs; therefore, I've allocated \$9.5M in FY04 with a gradual ramp up to over \$21M in FY09 ensuring we stay on track. Much of this money is dedicated to implementing our education pro-

gram—the Space 100, 200 and 300 courses, the Advanced Space Training courses and the travel costs for bringing students to these essential classes. We have also set aside funds to build and sustain a database to categorize our Space Cadre members and to track their individual expertise. And lastly, some administrative funding is reserved to support the Space Professional Development Task Force, which has now migrated into a permanent Space Professional Management Office at Air Force Space Command. This unit is responsible for the oversight of all space professional development activities, including education and certification.

Mr. EVERETT. According to the Air Force's space professional strategy, the Air Force will cultivate relationships with space professional development offices across DoD. What efforts have been made to develop these relationships and what have been the results?

General LORD. Our Space Professional Management Office routinely meets with representatives from each of the other Service's Space Cadres. Notably, all of the Service Space Cadre development teams joined together to assist the National Security Space Office in developing the Space Human Capital Resource strategy and they continue to meet in this capacity. We also interact directly with the other Services by incorporating their Space Cadres into our Space 200 course. In addition, they will soon participate in the development of and attendance at Space 300. The benefit of offering our space education classes to the other Services is an open exchange of ideas, a deeper understanding of their roles and missions, and a better definition of their requirements. Space is inherently joint; therefore, we must continually work to foster close relationships with the other Services.

Mr. EVERETT. Please tell us about the establishment of a permanent Space Professional Management Office. What role would this play in development of a space cadre? Is this something that could provide a model for the other services?

General LORD. As you may recall, when the Secretary of the Air Force approved the AF Space Professional Development Strategy, he designated the Commander of Air Force Space Command as the Space Professional Functional Authority (SPFA), responsible for the development of the Air Force Space Cadre. Historically, each occupational specialty has a Functional Authority that resides at the Pentagon. However, in this particular case, my unique role as the SPFA is to develop space expertise across numerous specialties, which involves multiple functional authorities. Fortunately, this is made somewhat easier by aligning our efforts under the Air Force's overall Force Development construct. To help me oversee the management and implementation of all our on-going activities, we created the Space Professional Management Office (SPMO) here at Air Force Space Command. They will develop and coordinate policies and guidance, maintain a master database used to track space experience, manage the space certification process, ensure linkage to Force Development, and provide liaison with other Services Space Cadres.

As you know the size and skills of each Service's Space Cadre are vastly different and one size does not fit all. However, we remain in close coordination with each of the other Cadre managers and everything we implement will certainly be shared.

Mr. EVERETT. The Army does not yet have a formal space cadre strategy. What steps is the Army taking to complete such a strategy and what are the components you expect to include in the strategy? Why has it taken so long for the Army to begin planning for developing its space cadre?

General DODGEN. The Army has a strategy for managing our current space cadre comprised of Functional Area (FA) 40A, Space Operations officers and FA40C, Army Astronauts, although that was not effectively communicated clearly to Congress nor the General Accounting Office previously. The strategy is outlined in Chapter 41 of Department of the Army Pamphlet (DA Pam) 600-3, Officer Professional Development. It provides direction and guidance for unique features and characteristics required of our FA40 officers and on developmental assignments, training opportunities and career paths that should be pursued across the lifecycle of an officer's career. Army Space Cadre strategy encompasses officer acquisition, training, professional development, sustainment, deployment, distribution, structure, and separation. The Army is currently updating DA Pam 600-3 incorporating key aspects of our Officer Personnel Management System 3 and ongoing lessons learned. DA PAM 600-3 is on schedule for completion during 2nd quarter FY05. Updated Army space cadre strategy will include a better definition of the type of education and experience we require of officers accessed into the space cadre. Future updates will integrate findings of the Army Space Cadre Force Management Analysis (FORMAL), which will help us address our warrant officer, non-commissioned officers, enlisted and civilian populations.

Mr. EVERETT. What steps is the Army taking to assess its requirements for space professionals to meet the needs within the Army and in joint activities?

General DODGEN. The Army's requirements for a space cadre are primarily in support of operations. Requirements for our current cadre within the Army have been determined by validation of operational concepts through experiments, wargames, and exercises and ultimately through the Total Army Analysis (TAA) process over the past six years resulting in 90 authorizations for Space Operations officers across the Army. The majority of these authorizations (66%) are at the operational and Service level. As the Army transforms to modular units, we are reassessing and growing requirements within our tactical force, again, based on validation of operational concepts to determine the officers, training, and equipment required at each tactical echelon. Our requirements in joint activities (47 authorizations) are identified through close coordination with the joint commands and organizations to ensure the Army provides the right quantity and quality of officers to meet operational requirements.

Mr. EVERETT. The Army has said that it cannot complete the identification of its space cadre until two studies now underway are done. Why are a 5-year study and a 15-month study required to define the Army space cadre? Can the Army develop a space cadre strategy and designate a space cadre organizational focal point before completing the identification of its space cadre?

General DODGEN. The Army has a strategy for our current cadre as outlined in DA Pamphlet 600-3 and has designated the Functional Area 40 Personnel Proponent Office, US Army Space and Missile Defense Command as its organizational focal point. The 15-month study, the Army Space Cadre Force Management Analysis (FORMAL) is necessary to ensure we conduct a thorough assessment across the entire Army and reach consensus. Space expertise has been decentralized throughout the Army for over 30 years, so it will take sufficient time to identify not only what the cadre will be comprised of, but how to track/manage it across the personnel lifecycle functions to meet the needs of the Army and joint/interagency organizations. All studies concerning space cadre have been integrated as part of the FORMAL, and are scheduled for completion in August 2005, including the five-year Army Enlisted Space Study, initiated in 2000 to assess the lifecycle management of soldiers.

Mr. EVERETT. Please explain the Force Management and Analysis review phases for space cadre. Include deliverables and duration.

General DODGEN. The four phases, deliverables and duration are: Phase I- Develop Army-unique Space Cadre Definition; Objective and deliverable is a working definition of the cadre for use throughout phases 2 through 4; duration is Jun-Oct 04; Phase II- Identify the Army Space Cadre; roles, missions, organizations, functions, and skills; Objective and deliverable is a comprehensive database of potential space cadre population based on Phase I definition for officers, warrant officers, non-commissioned officers, enlisted and civilians; duration is Sep-Dec 04; Phase III: Conduct Functional Review; Objective is to reduce the potential cadre population to those personnel that can be managed and highlight those that cannot; deliverables include development of comprehensive DA policies on how to manage the Cadre across the eight personnel lifecycle functions of acquisition, distribution, structure, training, professional development, deployment, sustainment, and separation; duration: Jan-Apr 05; Phase IV Conduct a comprehensive Doctrine, Organization, Training, Materiel, Leader Development, Personnel and Facilities (DOTMLPF) analysis and update the Army Space Cadre Strategy; Objective and deliverables include an analysis of courses of action and updated Army Space Cadre Strategy and identify costs and impacts to Army; duration: May-Aug 05. Final briefing to Vice Chief of Staff, Army scheduled for August 2005 in order to impact development of FY08-13 Program Objective Memorandum (POM).

Mr. EVERETT. What funds has the Army budgeted for developing, managing, and maintaining a cadre of space qualified professionals?

General DODGEN. The Army has budgeted \$1.12M for FY05: \$450K for training FA40 officers in the Space Operations Officer Qualification Course, an eleven-week course that now includes incorporation of the National Security Space Institute Space 200 (S200) course; and \$70K for advanced civil schooling and training with industry opportunities (7 officers at \$10K per). In addition to training, the Army has budgeted \$600K for the management of the cadre executed by the FA40 Personnel Proponent Office (\$200K civilian pay, \$400K OMA for contract support, execution of an Annual FA40 training Conference, and administrative costs). In addition to this, there is associated military pay for salaries for a small group of officers that develop, manage, and maintain our cadre, but those officers execute other duties as well and aren't specifically budgeted against the cadre.

Mr. EVERETT. What specific training efforts has the Army developed to train its space cadre and its "space smart" people? How has space been integrated into Army

Professional Military Education? How does the Army expect to participate in the development and eventual use of the National Security Space Institute?

General DODGEN. The Army developed the Space Operations Officer Qualification Course for its space cadre in 2000 and will graduate its seventh class on 19 November. With this graduation there will be 124 graduates in the Army of which 87 are FA40s, one US Air Force officer, and three US Marine Corps officers. The course is currently eleven weeks long and there will be two classes in FY05. Additionally the Army developed and executes three-week assignment specific training for officers assigned to Space Support Elements of the UEx that focuses on space related equipment and tools training and operational support tasks. FA40s assigned to the Army's 1st Space Battalion as an Army Space Support Team (ARSST) also receive specialized training and certification as part of assignment in the unit. The Army additionally has other training efforts for "space smart" people that are not currently part of the cadre such as the Satellite Communications Course for MOS 31S soldiers and Signal Corps officers, as well as tailored space training blocks of instruction at the Military Intelligence officer basic and career courses.

In addition to training, the Army has developed a strong continuing education and training with industry program, sending 5-7 officers to obtain Masters Degrees in a space related subject and to work with Space industry partners for a one year assignment.

Space is integrated into Army Professional Military Education at Army Command and General Staff College where Operation Career Field officers can take either a 40 or 81 hour Space Operations elective course/track. Approximately 300 officers participate in these electives each year. There is additionally a Space elective course offered at Army Senior Service College.

The Army is very much a part of the formation of the National Security Space Institute, having already integrated one of its courses (S200) as the foundation for our Officers Qualification Course. Additionally, the Army has established an Army training office in the NSSI, providing two FA40s on the instructor staff, and is pursuing other opportunities in the administrative and management elements as well. The Army also participates in NSSI sponsored work groups to determine development of future courses such as the Senior Space 300 course (S300). The Army looks forward to participating in the multi-service planning for the future of the NSSI and other course development.

Mr. EVERETT. What is the significance of the revised Navy space policy for organization and management related to Navy space personnel?

Admiral MCARTHUR. The revised Navy space policy offers an updated, overarching governing document that provides structure, rigor and formalizes the process. The revised Navy space policy prescribes the two broad functions that the Navy space cadre will carry out- and signals the Department's intentions to strategically place these personnel within the National Security Space community. In terms of functions, the Navy space cadre will "(1) integrate the essential capabilities provided by space systems at every appropriate level throughout the naval force; and (2) shape the outcome of joint deliberations on future space system capabilities to ensure the combat effectiveness of naval forces." A professional space cadre available for appropriate senior leadership positions in joint, national, and naval space programs and organizations will accomplish these important functions.

Mr. EVERETT. What will be your formal role as the advocate for the Navy space cadre?

Admiral MCARTHUR. I will oversee adherence to the space policy, manage the space cadre, and insert space experience into appropriate billets and assignments.

Mr. EVERETT. Will you have any responsibility or authority for managing the Navy's space cadre?

Admiral MCARTHUR. Yes. The Director, Navy Staff will assign the Commander, Naval Network Warfare Command as the lead for space cadre with appropriate authorities.

Mr. EVERETT. The Navy has appointed an officer to be an advisor to the Navy and to members of the space cadre. What will be the formal roles of the Navy space cadre advisor and the assistant advisor?

Admiral MCARTHUR. The Navy Space Cadre Advisor, in partnership with the individual's parent community manager, is responsible for overall space cadre career planning and management and is located in Washington, DC. The space cadre advisor is the lead point of contact within NAVPERSCOM for all matters relating to the space cadre and is responsible for the following:

- Overseeing space cadre policy and management implementation.
- Coordination with National Security Space organizations on space cadre matters.

- Liaison with space cadre, community managers, and commands/organizations having space-coded billets.
- Development of guidelines for the management of space cadre career patterns.
- Analysis of statistics concerning the utilization of space cadre officers in space-coded billets and promotion trends.
- Analysis of requirements versus inventory for all designators of space-coded officers as a basis for educational programs and selection board requirements.

The O-5 Assistant Navy Space Cadre Advisor assists in the completion of duties assigned to the Navy Space Cadre Advisor. The Assistant Navy Space Cadre Advisor is located in Millington, TN and works directly with the detailers for assignment of space cadre members and is responsible for the following:

- Liaison with space cadre, detailers, placement officers, and commands/organizations having space-coded billets.
- Compilation of requirements versus inventory for all designators of space-coded officers as a basis for educational programs and selection board requirements.
- Development of statistics concerning the utilization of space cadre officers in space-coded billets and promotion trends.

Mr. EVERETT. What will be your relationship with the space cadre advisor?

Admiral MCARTHUR. The space cadre advisor will help in the day-to-day management provide periodic updates on implementation progress and space cadre status.

Mr. EVERETT. What are your plans to grow the size and scope of this office for the support of space cadre development?

Admiral MCARTHUR. The space cadre management office consists of the space cadre advisor and assistant advisor. As we continue to identify additional cadre members (enlisted, civilian, and reserves), the office may increase in size to support the increased workload. At this point, our plan is to operate as is for a year and then reassess.

Mr. EVERETT. What priorities do you see for the development of the Navy space cadre in the near term?

Admiral MCARTHUR. The initial priority has been the identification of the active duty officer space cadre, and placement of that cadre into key National Security Space and Navy positions. Additionally, we are identifying space-related fleet billets to add to our space cadre billet base. This is the essential first step toward shaping the future of National Security Space to ensure the combat effectiveness of naval forces. Developing the Navy Space Cadre Human Capital Strategy is our current priority.

Mr. EVERETT. How does the Navy plan to adapt its personnel system to accommodate development of your space cadre?

Admiral MCARTHUR. The Space Cadre Advisor and Assistant positions have been added to the Navy Personnel Command, Bureau of Naval Personnel staff, directly interfacing with all personnel management functions. Navy has developed a Space Cadre Reporting Tool, using the existing personnel databases to track space cadre information. Additionally, a new Policy Decision Memorandum (001-04) directs the detailers to preemptively consider space expertise when assigning officers to space billets. The Navy Space Human Capital Strategy will be integrated with the overall Navy Human Capital Strategy.

Mr. EVERETT. What training classes has the Navy developed that specifically focus on developing space cadre among its ranks?

Admiral MCARTHUR. Navy has been working with the Air Force Space Operations School to ensure that Navy requirements are captured in their courses.

Mr. EVERETT. How has space been integrated into Navy Professional Military Education?

Admiral MCARTHUR. Space education has long been embedded in some of our key educational institutions, to include the Naval Academy and the Naval War College. The Naval War College includes a section on Navy use of space in its core curriculum and also offers more in-depth electives on space systems. The cornerstone of our space education program is the Naval Postgraduate School (NPS) with the space systems operations and space systems engineering curricula. The Space Systems Certificate program at NPS is a distance learning initiative to make space education available to even more officers. Additionally, Navy is participating on the Space Professional Oversight Board to provide a standardized approach among all service schools and concentrate on general, high-level space operations.

Mr. EVERETT. How does the Navy expect to participate in the development and eventual use of the National Security Space Institute?

Admiral MCARTHUR. Navy is working with the joint working group to develop specific course requirements and initial curricula. We have sent students to the proto-

type courses and provided feedback to ensure Navy specific issues are addressed. Additionally, we have provided reserve space cadre instructors as part-time faculty. Navy intends to use the Space Operations School courses to train their space cadre to the maximum extent practical.

Mr. EVERETT. How will the Navy use its space cadre in ships, aviation squadrons, and submarines to leverage space assets?

Admiral MCARTHUR. Navy has been using space systems for many years, supporting maritime and joint warfighters through established command and control in theater. The focus on space cadre will allow us to capitalize on the existing space systems and products even more. We are currently looking at the evolving fleet structure, to include the formation of our new Carrier and Expeditionary Strike Groups to determine where within the Fleet space expertise is best used. Currently, the Joint Forces Maritime Component Commander in each theater ensures there are provisions for space effects to naval operations.

Mr. EVERETT. How has the Navy developed space cadre among its heart and soul—the chiefs?

Admiral MCARTHUR. While the enlisted corps is a part of the space cadre, our initial steps have been focused at the officer level. We have not yet developed specific objectives and career goals for the enlisted. However, many enlisted are currently involved in space at the Joint Intelligence Centers, National Reconnaissance Office, United States Strategic Command, National Security Agency, and Navy commands.

Mr. EVERETT. What future partnerships, in and out of the Department of Defense, does the Navy plan to engage for the purposes of space cadre development?

Admiral MCARTHUR. Our plans at this time include partnerships across the Services and National Reconnaissance Organization, under the leadership of Mr. Teets. We plan to evolve and develop partnerships with United States Strategic Command and deployed joint organizations.

Mr. EVERETT. What training plans specifically for space cadre has the Marine Corps developed? How is the Marine Corps exploring opportunities to level the training provided by other services? How has space been integrated into the Marine Corps' Professional Military Education?

General THOMAS. What training plans specifically for space cadre has the Marine Corps developed?

The Marine Corps has two different Military Occupational Specialties (MOS) in its space cadre: the Space Operations Officer (MOS 9666) and the Space Operations Staff Officer (MOS 9933). The education and training plans are as follows:

- The Space Operations Officer (MOS 9666) is and will continue to be educated at the Naval Postgraduate School, where he or she earns a Master's Degree in Space Operations. These officers form the nucleus of our space cadre and serve in key National Security Space billets, working space issues on a daily basis. We have worked with the Naval Postgraduate School to tailor our students' curriculum to:

- Meet the specific needs of the Marine Corps and to better prepare our officers for their follow on assignments

- Leverage their research work while at the Naval Postgraduate School.

- Our Space Operations Staff Officers (MOS 9933) serve in billets that do not require the rigorous 2-year technical curriculum offered by the Naval Postgraduate School. Rather, our Space Operations Staff Officers are required to have completed a two-week training course and 6-months of on the job training in a space related billet. These officers have historically been trained at the Air Force Space Command Space Operations School in the Interservice Space Fundamentals Course, the Interservice Space Intelligence Operations Course, or the Advanced Space Operations Course.

How is the Marine Corps exploring opportunities to leverage the training provided by other services?

The Marine Corps relies exclusively on education and training provided by the other Services to prepare our space cadre personnel for their assignments in National Security Space.

We have worked in concert with the Naval Postgraduate School to develop tailored curricula to support our officers, and feel that we have developed specific tracks that will not only better prepare our personnel for their follow on assignment, but also provides meaningful research in support of the Marine Corps' objectives in National Security Space (NSS). The Naval Postgraduate School has been very receptive to our ideas and initiatives, and we have been very pleased with the education that our officers receive and the subsequent contribution they make to Marine Corps' operations and efforts in NSS.

The Marine Corps is also working closely with the U. S. Army Space and Missile Defense Command and Air Force Space Command to develop courses that will sup-

port the development of the Marine Corps space cadre. In support of this effort, the Marine Corps has assigned a Marine officer to Air Force Space Command's Space Operations School, and have provided the school detailed educational skill requirements for the training of our Space Operations Staff Officers. The Space Operations School, in turn, is working to assess these requirements and recommend courses to support Marine Corps needs. Many Marines have completed space operations training courses, and during the past year Marines have attended both the Army's FA40 Space Operations Officer Qualification Course as well as the Space Operations School Space 200 course. The Marine Corps plans to continue sending personnel to space training courses, not only to provide them with the space training they need, but just as importantly, to interact with personnel from our sister Services. This interaction in the classroom will help foster the understanding between the Services, ultimately leading to a more capable joint force. We look forward to continuing to work with the Space Operations School and the NSS community to develop relevant, rigorous joint courses that will meet the warfighters needs.

How has space been integrated into the Marine Corps' Professional Military Education?

We recognize the importance of providing information regarding space capabilities to officers throughout the Marine Corps. As such, we have worked to incorporate space education in both our resident and non-resident professional military education (PME) programs. We have recently provided detailed course outlines and video instruction as part of our intermediate level school distance education program. This course of instruction reaches approximately 4500 officers throughout the Marine Corps, presenting them with an overview of space capabilities, limitations, and planning considerations. Additionally, we have integrated space education into our resident PME courses, providing blocks of instruction that provide overviews of space capabilities as well as current lessons learned.

Mr. EVERETT. How does the Marine Corps plan to integrate and use its space cadre in the Marine Air-Ground Task Force organization in order to increase the leverage of space?

General THOMAS. The Marine Corps' warrior ethos is firmly grounded in the Marine-Air Ground Task Force (MAGTF) and the premise that every Marine is a rifleman. Our approach to the space cadre is no different, we require MAGTF officers who are "space smart". As such, we recently completed a review of Marine Corps Tables of Organization and have completed a T/O Change Request to add the Space Operations Staff Officer skill designator MOS to billets in our Marine Expeditionary Forces, Marine Expeditionary Units, Marine Aircraft Wings, and Marine Divisions.

The officers in these billets, who understand the Marine Corps warfighting doctrine and ethos and are educated and experienced in space, will make space capabilities operationally relevant at the lowest tactical level. Further, these officers will have the ability and be in position to influence National Security Space requirements, planning, programming, and doctrine.

Mr. EVERETT. How does the Marine Corps plan to adapt its personnel system to accommodate development of the space cadre?

General THOMAS. The Marine Corps created a new skill designator Military Occupational Specialty, the Space Operations Staff Officer. The purpose of creating this skill designator was twofold:

First, it serves to identify those officers with space education and experience. These officers make up the majority of our space cadre, and are the officers that provide space experience to the MAGTF. As they are now identified by the 9933 MOS, they can easily be tracked and monitored by the Space Billet Sponsor (Deputy Commandant for Plans, Policies, and Operations) and the personnel system (Deputy Commandant for Manpower and Reserve Affairs).

Second, the MOS serves to identify billets in which space operations training and experience are required. This allows the Billet Sponsor and Manpower to assign the right officer to the right job.

Mr. EVERETT. The Marine Corps has contracted a study to help in managing its space personnel. How will this contribute to managing space positions, determining personnel requirements, and assessing available training and education requirements?

General THOMAS. The study provided us with a detailed training plan, an assessment of current structure, recommendations for new space cadre billets, and a database that can be used by the Billet Sponsor to track space cadre personnel. As such, this study has been the cornerstone of three Table of Organization Change Requests designed to designate Marine Corps space cadre billets. Further, the study provided us with a standard operating procedure for screening and designating space operations staff officers. Finally, the study made recommendations that have been the

foundation of our ongoing discussions with the Space Operations School regarding space cadre training for Marine Corps personnel.

Mr. EVERETT. Explain the Matrix of Educational Skill Requirements. What is it? How will you develop it? When will it be complete? How will you use it?

Dr CALICO. The term Educational Skill Requirements (ESR) is not used by AFIT or the AF. It is a term used by NPS to delineate the specific skills, as specified by the customer, required of a graduate assigned to a Naval job position (or Navy P-codes). However, in a similar manner, the Air Force uses the Academic Specialty Codes (ASC) for its academic programs and Air Force Specialty Code (AFSC) for the job positions. The two systems are similar in intent, but they are not equivalent.

What is, desired is a common definition of terms, that will allow the Space Cadre (independent of Service origin) to match their specific educational requirements to a specific academic program. This process begins by defining specific core competencies required for space-cadre members, and then matching those to the appropriate ASC (or ESR). This in turn, identifies the program at AFIT (or NPS) in which to enroll the student.

The development of the matrix is a specific goal of the Joint Space Academic Group (JSAG), formed under the AFIT/NPS alliance. Completion of the tool is dependent on a refined set of educational requirements for the Space Cadre, which is a current action item for the Space Professional Development Team, as part of the Joint Space Oversight Board (JSOB).

In summary, both AFIT and NPS already have matrices of skill requirements which can be combined to form a single set—this action can be accomplished within the next couple of months. A more complete set of skill requirements will require that the educational requirements for the space cadre be better identified.

Captain BURSCH. [The witness did not respond in a timely manner.]

Mr. EVERETT. How would your programs adapt to the increasing need of a space cadre? Do you have the right focus to satisfy the requirements of developing a space cadre? Should your space-oriented programs be opened to a larger number of students? Do your programs sufficiently address the needs of intelligence for the purposes of National Security Space?

Dr CALICO. AFIT has a long history of adapting its programs to the needs of the Air Force and DoD and has already made important changes to meet the needs of the space community and will continue to do so. As an example in 2001, AFIT made a major modification to its space operations program in response to input from Air Force Space Command. Working directly with the AFSPC staff, a team of AFIT faculty strengthened the emphasis in both space and information operations, as well as adding a course in space systems acquisition management. The resulting program includes core courses in spacecraft systems engineering, space flight dynamics, space environment, satellite communications, space surveillance, space intelligence, and an introduction to space operations and systems. Students then specialize in one of several different space related areas and complete a thesis on a topic of current interest to the space community.

This continuous process of adapting programs to meet evolving customer needs involves several elements. First AFIT communicates on a regular basis with its customers both formally and informally. One-half of AFIT's faculty is active duty military officers who come to AFIT with prior military experience and after a four-year assignment on the faculty are assigned to AF and joint billets. These faculty officers provide great connectivity to our customer base. Second, AFIT has an aggressive program to align our research to AF and DOD priorities. Each year our research office sends its annual research report, along with a solicitation letter, to hundreds of offices around the AF and DoD. Continual interaction of our faculty and students with research sponsors and the future employers of our students provides early access to emerging trends. Finally, we conduct formal program reviews with our customers and stakeholders as well regularly survey past graduates and their supervisors.

I definitely believe our space-oriented program should be open to a larger number of students. While the final numbers are not available, the services have already identified a space cadre of over 8000 uniformed personnel. This does not include other space professionals that are not part of the cadre or an additional 3000+ civilians, guard and reservists. Just as space 100, 200, and 300 are envisioned as important to this entire population, space-oriented graduate education should be available to some percentage of this same group.

Current curricula and research do address the intelligence needs of National Security Space. We will continue to work with our customers to make sure we are aware of their needs and have adjusted our curriculum to meet those needs. We have a visiting faculty member from the NRO, and a close working relationship with the NGA with our MASINT program. AFIT also has a close working relationship

with the National Air and Space Intelligence Center collocated at WPAFB and regularly uses their secure facilities for both classified lectures and research. This fall AFIT will open a large SCIF facility on campus to further enhance our capability. AFIT is dedicated to ensuring that we continue to meet NSS intelligence needs.

Captain BURSCH. [The witness did not respond in a timely manner.]

Mr. EVERETT. Has DoD adequately addressed the Space Commission's conclusion in 2001 that DoD did not have a strong space culture, including focused career development and education and training? What more does DoD need to do to address these important areas? How can industry and academia contribute?

Dr CALICO. I believe the DoD has made an impressive start in developing a strong space culture. The identification of a space cadre and the development of a comprehensive training program for all levels of the cadre are major accomplishment. These elements were certainly the most pressing and needed immediate attention. The education piece is being worked but much remains to be done. The alliance between AFIT and NPS and the formation of Joint Space Oversight Board (JSOB) has given this area the appropriate focus and visibility. The JSOB has the key role in identifying space graduate education requirements across the services but the individual services will have to deal with the larger career development issues.

Industrial employee career development plans may serve as an example for DoD implementation—particularly for developing the technical and managerial expertise of the space cadre. Civilian academic institutions will continue to be the primary source of undergraduate education in space related disciplines for both uniformed military (new accessions other than from service academies) and civilians. The services will continue to rely on civilian academic institutions to provide part-time off-duty education to both civilians and military personnel and full-time education to civilians, and in some instances, to uniformed military. Civilian institutions will also play a vital role in doing research in support of the nation's space efforts. AFIT and NPS will, of course, concentrate their efforts on meeting the specific educational needs of the space cadre and the research needs of DOD.

Mr. DOUGLASS. AIA agrees with the August 11, 2004 assessment of the General Accounting Office (GAO) that the Department of Defense (DOD) has commendably responded to the Rumsfeld Commission's charge in developing a department-wide space human capital strategy with guidelines for personnel integration and program execution. At the same time, as the GAO noted, the Pentagon must still work on the implementation of space program timeframes as well as quality control and evaluation measures.

Industry and academia can most aggressively support DOD's strategy through systematic coordination with Armed Services program managers on the research, design, production, and testing milestones required to deploy and operate complex military space systems. This process of continuous joint evaluation can ensure a closer alignment of industry resources with DOD requirements and enable the private sector to assemble stable, integrated project teams.

Dr. SHOCKLEY-ZALABAK. UCCS is not in a position to comprehensively address either DOD's overall space culture or its individual aspects. We do believe that DOD has taken a number of significant steps since 2001, including Air Force Space Command's training program and the decision to include civilian institutions to complement military education and training efforts. These efforts appear to represent a very real step forward. However, the real evaluation of success will not be possible until a larger percentage of the space cadre have received their training and the consortium of civilian institutions has been established and has had time to meet its objectives. The evaluation strategy will need to include quantitative measures such as number of space-related graduate degrees earned as well as more qualitative measures such as knowledge levels and job performance. Through communication with and among all participants and stakeholders, we are dedicated to working as a team to evaluate progress and to make changes as needed in order to best achieve the desired end results.

Industry and academia contributions will initially improve integration of current efforts. As we establish and manage the consortium, we will better understand the overall needs and can develop programs and other mechanisms to meet those needs. The needs assessment must be a continuing function informed by previous experiences and reflecting future space systems design development, operation, and application requirements. Industry, can and will, be supportive of these efforts. They will in turn benefit from the military initiatives by seeing a better pipeline of graduates entering their workforces.

Dr. COVERSTONE. DOD is not primarily oriented toward space and the rewards for doing so do not compete with careers in operational military units. There are elements of expertise in DOD space professionals but these rely on captive civilian contractors (such as Aerospace Corp) or civilians and contractors at research centers

such as the Naval Research Lab. Since space is a specialized discipline it is not usual to find military personnel with a long history in the space area. These issues could be addressed by recognizing the disciplines needed for a space professional and sending qualified people to be trained. It would be sufficient to provide mostly MS-level trained space individuals mixed with a few Ph.D.'s.

It is not clear that industry can train DOD professionals very efficiently, however academic institutions which already train the majority of the professionals for industry is quite capable of adding a cadre of DOD professional students. There are about 10 graduate schools with very strong graduate programs in various aspects of space science and engineering. For example, the University of Illinois could easily add 10-20 new students in this area each year if funding were available. We have ramped up to this extent several times in the past when the demand was there.

Captain BURSCH. [The witness did not respond in a timely manner.]

Mr. EVERETT. Are there any "best practices" from other government organizations or the private sector you would recommend to improve the management, integration, and development of the space professionals of the country? Can you provide specific recommendations for military space cadre?

Dr. CALICO. I'd recommend a review of the educational makeup of successful DoD space contractors and National laboratories in space related business to benchmark the existing technical education and experience level that exists in those organizations. The DoD should then strive to at least be on par with the technical expertise possessed in the private sector, in particular as measured by the number of space related undergraduate and graduate technical degrees.

Once these educational benchmarks are determined, they need to be compared to the current composition of the Space Cadre. If it is determined that the current Space Cadre has an educational deficit, than AFIT and NPS should be used to eliminate this shortfall.

Mr. DOUGLASS. Several large aerospace companies, often in cooperation with organized labor and educational institutions, conduct apprenticeship and knowledge management programs to identify skill shortfalls and to expand technology and management training opportunities. These initiatives have the common goals of high-skilled employee retention, management continuity, and continuing education on the most advanced automated techniques in the design, engineering, and manufacturing arenas. Programs of this nature enhance the ability of industry professionals to capture and transfer the technical expertise needed to deploy aerospace platforms with complex communications, navigation, and surveillance (CNS) assets.

As the Rumsfeld Commission implied, high leadership turnover in military space programs encourages the view that this increasingly important sector of America's national security network nevertheless exists as a temporary assignment rather than a vital war fighting profession. The single most significant factor in the cultivation of professional military space cadres, therefore, remains the establishment of clear DOD career paths that offer junior and midlevel officers training and promotion opportunities commensurate with those that support more traditional occupational specialties.

Dr. SHOCKLEY-ZALABAK. Air Force Space Command has used the military's experience in weapon systems training and even more specialized training such as Special Operations as a model in developing its new training program. The available "best practices" outside the military will be identified through activities within the consortium and then evaluated as to their applicability for the space professional. Where modifications are suggested, they will be identified. The consortium will then work with Air Force Space Command and others to implement the results of the "best practices" evaluation.

UCCS has had considerable experience with preparing military officers and civilians for their duties in areas where they have inadequate preparation. In early 2001 the Network Information and Space Security Center (NISSC) worked with U.S. Space Command to identify the educational objectives for key members of their staff in the area of information assurance. U.S. Space Command had been assigned the Computer Network Defense and Computer Network Attack missions over the previous couple of years and found that they did not have an adequate knowledge base with their headquarters. As a result of the needs assessment, UCCS defined a graduate certificate program consisting of three new courses in addition to an existing course. This program was delivered in an accelerated format at Peterson AFB, Colorado, to personnel identified by the Command. The year-long program was very well received by both the participants and the Command with feedback indicating that the significant increase in knowledge and understanding of computer and network security contributed to improved job performance. At the university, we developed a new master's program in information assurance based on the work with U.S. Space Command.

We have used the same approach with U.S. Northern Command. An initial cadre of NORTHCOM students will soon complete the four graduate courses defined based on a needs assessment within the headquarters. Over 30 additional students will begin that program at the end of August, 2004. In addition, the courses are also available for others in the community, including contractors and university degree seeking students. The curriculum is also being shared with other institutions through the Homeland Security/Defense Education Consortium of which UCCS is one of the founding members. The courses included in the certificate program are:

- Introduction to Homeland Defense
- Interagency Relationships in Homeland Security and Homeland Defense
- Understanding the Threat
- Protection of Critical Infrastructures

Dr. COVERSTONE. Again we would encourage a mix of research funding and GSRP-like funding. We are concerned with the large numbers of highly qualified US citizen graduate students who need support. The current lack of support means that we are not developing this domestic resource as many go to industry instead of finishing a graduate education. We would use these programs to help this problem.

An example of developing a collaborative relationship for workforce training at Illinois is the Motorola Center Model. The company wanted early access to students for strategic staffing. By investing an annual block fund for research in the general field of communications, Motorola evaluates the performance of students over time to better place students within the company. Motorola maintains control of where the investments are made. This win-win situation provides Motorola with a well-trained workforce and Illinois with block research funding to focus efforts on technology and employment opportunities for students. This is merely an example of the training opportunities available at large public universities.

Captain BURSCH. [The witness did not respond in a timely manner.]

Mr. EVERETT. DoD plans to establish a national security space institute to be a multi-service resource for centralized space education and training. In your opinion, how would this help to eliminate existing overlaps and gaps in space education and training? How would this affect existing institutions that have courses related to space, such as the Air Force Institute of Technology, the Naval Postgraduate School, and civilian institutions of higher learning?

Dr CALICO. The NSSL, as I understand it, is focused primarily on providing career long space training for the space cadre. The three courses already developed Space 100, 200, and 300 appear to be excellent and utilizing them as the standard for joint training should prepare the current and future members of the space cadre for joint operations throughout their careers. This mission and focus is quite different from graduate education provided by AFIT and NPS. These courses are aimed at training people to operate and employ our national space assets. Graduate education is focused on providing graduates the fundamental understanding of basic principles and the latest developments necessary to create new space systems as well as to critique and improve the operation of current systems.

While it does not appear that the goal or mission of the NSSL is to provide graduate space education, I am aware that Air Force Space Command (AFSPC) and the University of Colorado at Colorado Springs (UCCS) have signed an MOU that would lead to a UCCS led consortium of universities. Although I have not seen the MOU, I believe the Air Force primarily sees this as a vehicle to expand the quality and availability of space related education for DoD civilians and contractors and to provide off-duty part-time education for military personnel who, due to frequent re-assignments, have difficulty completing a degree. AFIT and NPS primarily full-time defense focused education to military personnel. This effort should be complementary and should have little effect on the need for the graduate education provided by AFIT and NPS.

Both AFIT and NPS have long histories of supplying excellent graduate education for all of the services. The Joint Oversight Board formed as a result of an MOA between SECAF and SECNAV; it is chaired by Mr. Teets and contains high-level representatives of all services. It is charged with oversight of joint graduate space education and working with AFIT and NPS to ensure that the right education is available at the right time for all the services. This group will be working with AFSPC as well as the other services to identify requirements for graduate space education.

Mr. DOUGLASS. AIA applauds DOD's plan to establish a national security space institute. While each of the Armed Services requires flexibility in creating professional space cadres based on varying contributions to the military space infrastructure, DOD-level coordination of efforts will be critical to the future effectiveness of space programs since they yield strategic and tactical benefits to all war fighters in

a variety of operational environments. In this light, the proposed institute, by emphasizing the joint technological missions of military space components, holds the promise of reducing duplication of effort among Service personnel.

From industry's perspective, the planned institute could offer contractors and universities alike a central government-customer clearinghouse with which to cooperate on the identification of future math, science, engineering, production, and business management needs to sustain viable military space programs.

Dr. SHOCKLEY-ZALABAK. The establishment of a national security space institute can contribute greatly to the overall education and training solution. It will be important to determine and understand what the overall needs are in both a general and a specific sense, and then to identify where gaps exist. By recognizing and utilizing existing strengths of both military and civilian institutions, best approaches to closing the gaps can be determined. The needs assessment must be a continuing activity with both the needs and potential solutions made readily available for use by decision makers.

The Space Education Consortium can provide support in all phases of this process. As needs are identified, they can be matched with existing educational capabilities resulting in identification of gaps and overlaps. Resources can then be best applied to satisfy the gaps and to eliminate unnecessary overlaps. Overlaps may be beneficial to increase student bandwidth and accessibility or for other valid reasons such as to further develop education or research specializations.

Resulting from this analysis will be a greater understanding of where gaps and overlaps exist and can lead to resource allocation decisions based on identified needs. Existing institutions such as the Air Force Institute of Technology, the Naval Postgraduate School, and civilian institutions will be better able to differentiate themselves in meeting critical educational needs as well as to create instructional partnerships through which curricula can be exported to or imported from other institutions. This has the potential for providing maximum benefit to the customer, in this case the space professional cadre and the military, in a resource constrained environment.

Dr. COVERSTONE. AFIT and NPS are already underutilized national resources. We would not recommend establishing this institute until both resources are at capacity. If the intent is not to provide degrees, but short courses etc., including classified sessions, then the institute may make sense. If an institute is established, civilian institutes could participate through faculty sabbaticals and summer faculty programs. If degrees are not granted, we do not see much impact on civilian institutions.

Captain BURSCH. [The witness did not respond in a timely manner.]

Mr. EVERETT. At the recent Space Policy and Architecture Symposium, SMC commander, Lt. Gen. Arnold suggested part of the space professional development effort should include "smart seller" curriculum. He cited technical errors, systems engineering shortfalls, and business practice lapses. What industry training and education efforts are on-going that may address these issues? What other current continuing-education programs contribute to the development industry's space professionals?

Mr. DOUGLASS. AIA launched the *National Aerospace Workforce Solutions Initiative* this summer to invigorate our industry with a coordinated, broad-based human capital development program. Several elements of our new effort have the potential to address the engineering and business practice shortfalls highlighted by Lt. Gen. Arnold during the Space Policy and Architecture Symposium.

The *AIA Initiative*, which includes representatives from industry and government at all levels, will eventually document training shortfalls and critical skill requirements in 12 manufacturing-intensive states. This project, combined with the *Initiative's* focus on mentoring, work-study, and scholarship programs to stimulate high school and college student interest in aerospace careers, reflects in part the need to expand the industry's base of systems engineers.

Our *Initiative* also has a comprehensive program element for the analysis of best practices and lessons learned from workforce incubation programs at the state level. This analysis will provide the space community with a framework that identifies the most effective human resources management tools for the maintenance of efficient, customer-oriented industrial capabilities.

Mr. EVERETT. How can other universities and industrial representatives get involved in your efforts? How are you deciding whether or not to expand and if so, what criteria are you using for selection? What is the long term vision for the consortium?

Dr. SHOCKLEY-ZALABAK. The initial institutions considering membership in the Space Education Consortium (SEC) are reviewing the proposed consortium charter agreement and making final decisions regarding membership. Initial feedback has

been very positive. Other institutions should contact our Point of Contact, Dr. Bill Ayen (719) 262-3538, bayen@uccs.edu, to discuss their interest and to obtain a membership packet. Following the official announcement of the effort on or about October 1, 2004, we will actively publicize the consortium and will accept applications from all interested parties. This effort will continue as additional institutions gain knowledge of the consortium and determine an interest in membership. The SEC Advisory Board will establish application processes and membership criteria. The criteria will be consistent with the overall guidance provided in the charter agreement.

The long term vision is that the consortium be a robust and effective organization that supports the overall space education goals of both Air Force Space Command and the overall professional space cadre development initiative. The vision is in part contained in the following statements taken from the SEC Organization Charter and Membership Agreement:

"is a network of teaching and research institutions focused on promoting education, research, and cooperation related to and supporting the development of a professional space cadre concerned with the advancement of space systems design, development, operation, and application. The consortium is committed to building and maintaining a community of higher education institutions supporting this broad objective and the overall space effort through the sharing and advancement of knowledge. This is without respect to any particular boundaries between the missions of any particular military or civilian organization."

The consortium will promote and facilitate initiatives that contribute to the development and maintenance of a professional space cadre who are capable of carrying out the future military space role and the consortium will contribute to enhancing the use of civil space to support national economic and security goals. By including a wide variety of space education-related institutions in the SEC, we will be able to facilitate the sharing of programs and experiences, provide ongoing needs assessment and evaluation and access resources to satisfy the space community's unmet education, training, and research needs.

Mr. EVERETT. In your opening statement you suggested increased financial support is required for the development of space professionals. What level of investment do you believe would be required? To whom should the financial support go and how should it be used?

Dr. COVERSTONE. To produce MS and Ph.D. level professionals, we would propose a combination of support to universities through research grants and directly to students through a NASA-GSRP-like (Graduate Student Researchers Program) program. We don't know how many new space professionals are needed, but \$10 million a year in research support would support about 100 graduate students and currently NASA funds GSRP students at about \$25k per year. You should also continue to invest in the Naval Postgraduate School (NPS) and the Air Force Institute of Technology (AFIT). These schools do an excellent job in educating space professionals however, they provide very applied graduate education and the DOD needs to invest in places like Illinois as well to develop a broader, more academic and creative approach to DOD problems. Illinois and its peers also attract, we believe, on average more academically talented students.

QUESTIONS SUBMITTED BY MR. TURNER

Mr. TURNER. In your prepared testimony, you did not address the role of the Air Force Institute of Technology in educating space professionals in the Air Force. Could you explain how AFIT fits into an integral part of the Air Force's training of space professionals?

General LORD. The Air Force Institute of Technology (AFIT) is an invaluable part of the Air Force's overarching space education effort, which also includes the Naval Postgraduate School (NPS), the National Security Space Institute (NSSI) and the Space Education Consortium (SEC). AFIT is the Air Force's prime provider for in-residence graduate degree programs. AFIT provides a wide variety of Masters and PhD programs applicable to space professionals including an 18-month Graduate Space Systems program, focused on space systems engineering and space science. These programs provide critical technological knowledge for selected space operators and acquirers which greatly improves mission effectiveness. Advantages of AFIT programs are the military focus, classified course material and the ready access to military space organizations and information based on current military operations. Additionally, we will leverage the benefits of AFIT sponsored civilian institution degrees relevant to space.

The NSSI will provide space professional training through its Space 200 and 300 courses, which will be mandatory for space professionals. These courses are focused on space systems design, acquisition applications in joint warfare (Space 200—currently being taught), as well as doctrine, policy and requirements (Space 300—in development). Several Advanced Space Training courses will offer in-depth coverage of specific mission systems.

While we have completed work on identifying the mandatory training requirements for space professionals, we have not yet fully identified our mandatory graduate education requirements. Through the NSSI, we are working with AFIT to identify these requirements. We expect to complete this process within the next six months.

The SEC is a network of institutions focused on promoting education, research and cooperation to support space professional development. Course credit from member institutions leading to degrees and educational planning via a SEC website will offer additional opportunities to improve the knowledge of our space professionals. The University of Colorado at Colorado Springs serves as Air Force Space Command's lead university in managing the SEC. We see the SEC as complementary to the AFIT and NPS programs, offering an array of part time educational programs for military personnel, and full time for civilian students. An additional dimension of the SEC may be preparatory courses to help our space professionals qualify for AFIT and NPS programs.

In summary, AFIT is and will continue to be a prime provider of graduate education for space military personnel. SEC will complement AFIT's graduate programs for our space professionals through part-time and preparatory courses.

Mr. TURNER. Last year Congress passed legislation that authorized the Air Force to charge tuition for Navy and Army students. Could you provide an update on how that legislation has been implemented? Also, please comment on how this has increased the joint service capability of AFIT.

Dr. CALICO. After passage of the legislation, AFIT established a tuition charge for sister service students. However, in September of 2004, AFIT completed an Operational Readiness Inspection (ORI) from the Air Education and Training Command (AETC) Inspector General. The preliminary findings of the visit raised some issues concerning AFIT's reimbursable operations, which includes tuition collection and retention. AFIT is working with HQ AU and HQ AETC to resolve these issues, which may include additional language to help clarify AFIT's financial operations. While this investigation is ongoing, AFIT is still collecting tuition but keeping the funds in a separate account until all issues are resolved. AFIT has additional capacity to bring in more joint service students.

Mr. TURNER. Can you address AFIT's capacity for providing additional training to the space cadre by enrolling additional students?

Dr. CALICO. Starting in FY04 AFIT began a significant expansion which will allow it to enroll over 700 new AF students annually starting in FY07. This represents an addition of over 250 students from FY04 entries. Additionally AFIT could accommodate another 100 sister service entries if tuition funds can be collected and retained. AFIT could easily provide additional education to the space cadre within its current growth plan.

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